PATENT ABSTRACTS OF JAPAN

(11)Publication number : **05-181050**
(43)Date of publication of application : **23.07.1993**

(51)Int.Cl. G02B 7/08
G02B 7/09
G03B 5/00

(21)Application number : **04-016677**
(22)Date of filing : **31.01.1992**

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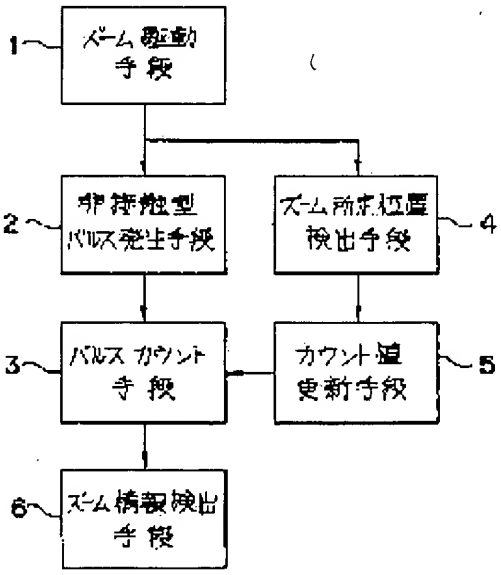
(30)Priority
Priority number : **03288900** Priority date : **05.11.1991** Priority country : **JP**

(54) ZOOM ENCODER

(57)Abstract:
PURPOSE: To nearly eliminate the defect of a relative value encoder in terms of principle in practical use with comparatively simple constitution without making the constitution of a zoom encoder large by making an absolute value encoder non-contact and without causing the increase of cost.
CONSTITUTION: This zoom encoder detects the turning amount and the turning direction of a cam ring which turns around the optical axis of a photographing optical system so as to change the focal distance of the photographing optical system. Then, it is provided with a non-contact type pulse generating means 2 which generates a pulse signal in accordance with the turning of the cam ring being a zoom driving means 1, a pulse counting means 3 which adds or subtracts the pulse signal in accordance with the turning direction of the cam ring, a position detecting means (zoom specified position detecting means) 4 which detects a specified position signal at least near the wide angle end and the telephoto end in the focal distance, a counted value changing means 5 which changes the counted value by the counting means 3 to a specified value in accordance with the change of the output from the means 4, and a zoom information detecting means 6 which obtains zoom information based on the output from the means 3.



LEGAL STATUS

[Date of request for examination]	15.04.1997
[Date of sending the examiner's decision of rejection]	
[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]	
[Date of final disposal for application]	
[Patent number]	2894659
[Date of registration]	05.03.1999
[Number of appeal against examiner's decision of rejection]	
[Date of requesting appeal against examiner's decision of rejection]	
[Date of extinction of right]	

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CLAIMS

[Claim(s)]
[Claim 1] The zoom encoder which detects the amount of rotation and the rotation direction of the cam ring to which the focal distance of photography optical system is changed by rotating around the optical axis of the photography optical system characterized by providing the following. A non-contact type pulse generating means to generate a pulse signal according to rotation of the above-mentioned cam ring. A count means to respond in the rotation direction of the above-mentioned cam ring, and to add or subtract the above-mentioned pulse signal. A position detection means to detect a position signal in near a wide angle edge and near a tele edge a focal distance at least. A counted value change means to change the counted value of the above-mentioned count means into a predetermined value according to change of the output of this position detection means.
[Claim 2] The above-mentioned position detection means is a zoom encoder according to claim 1 further characterized by detecting the predetermined mid-position in the staging area of the wide angle edge of the above-mentioned focal distance, and a tele edge.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to a zoom encoder and the zoom encoder used for the focal distance detection equipment of zoom photography optical system, such as a camera, in more detail.
[0002]
[Description of the Prior Art] As everyone knows, the zoom encoder which detects the amount of rotation and the rotation direction of the cam ring to which the focal distance of photography optical system is changed is used for the focal distance detection equipment of the zoom photography optical system in a camera etc. by rotating around the optical axis of photography optical system.
[0003] In order to detect the rotation position of the cam ring which performs zooming by rotation, this zoom encoder forms a several bits code board, contacts a brush to this code board, and it is made to detect the rotation position of a cam ring. It has the following faults, although there is an advantage that the detection means of a rotation position with this code board can detect the rotation position of a cam ring as bit information from a code board. That is, the manufacturing cost of 1 code board is high.
2) Since bit information has been acquired by contact of a code board and a brush, the defective continuity by oxidization of a code board front face and a brush side occurs with time.
3) The defective continuity by the shortage of contact pressure, surface wear, etc. occurs with time.
It will say that a defect occurs that a defect occurs with time like especially the above 2 and 3 among such faults, after crossing to a user's hand, and it poses a very serious problem on the quality of a product.
[0004] Therefore, in order to solve the fault of the above 2 and 3 fundamentally, it is possible to change into a non-contact type absolute value encoder like the magnetic formula which used optical or MR element etc. which used a zoom encoder of a contact process which was mentioned above for the photograph reflector etc. However, this means has the space of an encoder, and a conversely large demerit on cost. At most 2 - the triplet of expanding and the more it being thought that it is possible practically, the more this demerit enlarges resolution of a zoom encoder are limitations.
[0005] Then, a means to ask for the rotation position of a cam ring is proposed by preparing the optical pulse generator which answers the rotation of a cam ring which performs zooming using the zoom encoder of the conventional contact process, and generates a pulse, and counting up or counting down the pulse output from this generator according to the hand of cut of the cam ring for zoom as indicated by JP,2-5130,U. According to this means, the zoom encoder of a high resolution can be obtained only with one photo interrupter.
[0006]
[Problem(s) to be Solved by the Invention] However, the rotation position detection equipment using the zoom encoder indicated by above-mentioned JP,2-5130,U is the so-called relative-value encoder, and since it is not an absolute value encoder in a digital code like before, it has the following troubles theoretically.
(1) When a mistake count occurs by the incorrect pulse generated in the chatter ring of a pulse generator etc., it remains making a mistake, even if it changed the zoom state. Especially, in a non-contact type pulse generator, since an incorrect pulse occurs in the during starting of a zoom motor well, while making it carry out both-way movement of the zoom ring several times, a mistake count will be accumulated by it and it will have a serious bad influence for exposure and bit information as a result on it.
(2) Although the zoom value changed when the user pushed in or pulled the lens barrel, for example since the monitor of the output of a pulse generator was not necessarily carried out always, in the case of a camera etc., it cannot be detected, but after the zoom value has differed from the actual state, photography will be carried out to it, and it will have a serious bad influence for exposure and bit information as a result on it.
[0007] The purpose of this invention is to offer the non-contact type zoom encoder which is comparatively easy composition and is the theoretic fault which a relative-value encoder has and which can almost abolish practically the probability of occurrence of the trouble of the above (1) and (2), without causing enlargement of the composition by making non-contact the above-mentioned conventional absolute value encoder, and a cost rise.
[0008]
[Means for Solving the Problem] In the zoom encoder which detects the amount of rotation and the rotation direction of the cam ring to which the focal distance of photography optical system is changed by rotating around the optical axis of

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photography optical system as the encoder by this invention is shown in the conceptual diagram of drawing 1 O A non-contact type pulse-generating-means-2 to generate a pulse signal according to rotation of the above-mentioned cam ring which is the driving-means-1 to which the focal distance of photography optical system is changed, With a count-means-3 to respond in the rotation direction of the above-mentioned cam ring, and to add or subtract the above-mentioned pulse signal, it sets near a wide angle edge and near a tele edge a focal distance at least. A position-detection-means-4 to detect a position signal, and a counted-value-change-means-5 to change the counted value of the above-mentioned count means 3 into a predetermined value according to change of the output of this position detection means 4, It is characterized by providing a zoom-information detection-means-6 to acquire zoom information by the output from the above-mentioned count means 3.

[0009]

[Function] If the mid-position of a zoom moving range is arrived at, the counted value of a count means will be updated regardless of the number of pulse counts till then by the counted value corresponding to the exact focal distance.

[0010]

[Example] Hereafter, the example of illustration explains this invention.

[0011] Drawing 2 shows the 1st example of this invention, and this zoom encoder 10 is applied to the zoom lens lens barrel of a camera..

[0012] The zoom-encoder-10-formed-in-the-rotation-ring 20 consists of three of the fields C exceeding the collapsing section A, the photography range section B, and tele end position, as shown in drawing 3 , among these silver or white with the high A section and C section, and the B section of a reflection factor serve as low black of a reflection factor. Furthermore, among drawing of drawing 2 , the above-mentioned rotation ring 20 rotates in the direction shown by sign A or I, and drives a zoom lens. And the output signal of the zoom photograph reflector 11 (ZPR) fixed to the position in the main part of a camera changes with rotation of this zoom encoder 10. Namely, when the above-mentioned photograph reflector 11 has met the position of alpha shown in drawing 3 , it is a collapsed state, and when this photograph reflector 11 has met the position of beta and the position of a wide state and gamma is met, it is in a tele state.

[0013] The zoom drive unit 30 The zoom motor 31 and the slowdown reduction-gear train 32, The slit 33 which is prepared on axial extension of the above-mentioned zoom motor 31, is interlocked with this zoom motor 31, and is rotated, The zoom photo interrupter 34 (ZPI) which is arranged near this slit 33 and generates an output signal according to rotation of this slit 33, It consists of output reduction gears 35 which gear to the last reduction gear of the above-mentioned slowdown reduction-gear train 32, gear with the drive reduction gear 21 prepared in the periphery of the above-mentioned rotation ring 20, and transmit the rotation force of the above-mentioned zoom motor 31 to the rotation ring 20.

[0014] In addition, the above-mentioned photograph reflector 11 and the outgoing end of a photo interrupter 34 are connected to CPU101 (refer to drawing 4) mentioned later, and CPU101 detects the present focal distance based on the output signal of this photograph reflector 11 and a photo interrupter 34.

[0015] Drawing 4 is the block schematic diagram of the zoom camera with which **** 1 example is applied.

[0016] In drawing, CPU101 is a microcomputer which controls operation of the above-mentioned whole zoom camera, and manages LCD [the sequence control of this zoom camera operation, auto-focusing / auto exposure (henceforth AF/AE) operation, A/D conversion,] / Light Emitting Diode control, and a switch input control.

[0017] the LCD panel 102 -- the piece of a film -- it is the liquid crystal display board which displays a number, a battery check result, etc., respectively

[0018] 1st step switch 1R which the switch control unit 103 operates when half-push [release **], and locks AF and AE, When turned on with 2nd step switch 2R for shutter release which operates when all push [release **], switch Z-UP for a zoom rise, and switch Z-DOWN for a zoom down The power-on switch POWER which the above CPU 101 displays on the above-mentioned LCD panel 102, and changes the whole zoom camera into the state which can be photoed It consists of a switch RW for compulsive rewinding [which performs rewinding under photography], and a back lid-open close switch BK which winds having shut the back lid rapidly by detecting.

[0019] Moreover, light emitting diode (IRED) and a sign 123 show a position sensor (PSD), and, as for a sign 124, IC (AFIC) for AF ranging in the inside of drawing and a sign 105 and a sign 122 show a photographic subject. The above AFIC105 floodlights infrared light for a photographic subject 124 based on the control signal from the above CPU 101, and ranges by detecting the reflected light by PSD123. And the obtained ranging data are transmitted to CPU101 through a serial data bus.

[0020] EEPROM106 is eliminable ROM electrically and has memorized various adjustment values, such as the number of film **, **** correction value stroboscope charge voltage information, and battery check information.

[0021] The stroboscope unit 108 will start charge, if a charge signal is given from the above CPU 101, charge voltage is sent to this CPU101, after A/D conversion is carried out, it is compared with the charge voltage information on EEPROM106, and it is confirmed whether to be the completion of charge.

[0022] The Light Emitting Diode display 109 is a display which tells a photography person about stroboscope luminescence warning, AF lock, etc.

[0023] IF-IC111 is constituted from an IC for an interface by the Light Emitting Diode drive circuit, the circuit which measures the strength of the light by SPD110, the motor drive circuit, the reference voltage circuit, etc.

[0024] Both the signs 112,113 are supplied to this IC112,113 for a drive, after the motorised signal which is IC for motorised and is sent out from the above CPU 101 is once decoded within above-mentioned IF-IC111. And which motor of the above-mentioned zoom motor 31, the AF motor 115, winding up, and the rewinding motor 116 is chosen by the signal of CPU101, and it drives.

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[0025] Near the above-mentioned AF motor 115, the photo interrupter 126 which is interlocked with rotation of this motor 115 and generates an output signal is formed, and the above CPU 101 performs rotation control of this AF motor 115 based on the output of this photo interrupter 126.
[0026] Near the above-mentioned winding and the rewinding motor 116, similarly, the photo interrupter 127 which is interlocked with rotation of this motor 116 and generates an output signal is formed, and, as for the above CPU 101, rotation control of this motor 116 is performed based on the output of this photo interrupter 127.
[0027] The above-mentioned zoom motor 31 is controlled by CPU101 based on the output signal of a photo interrupter 34 and the photograph reflector 11, as mentioned above.
[0028] The automatic regulation material 120 is used as a checker at the time of performing AF, AE, battery check, stroboscope adjustment, etc. at works. Each of this data is sent to CPU101 through a serial data bus, and memorizes an adjustment value to the above EEPROM 106.
[0029] The DX code 150 of a film is directly read into CPU101, and is used as an operation value for deciding exposure value.
[0030] A sign 121 is a plunger for sector opening and closing, and a sign 125 is a detecting element which applies reset to CPU101 by the detecting element of a cell voltage at the time of a cell injection and returns of failed voltage.
[0031] Next, an operation of the zoom camera with which **** 1 example is applied is explained with reference to the flow chart shown in drawing 5 - drawing 8 .
[0032] Drawing 5 is the flow chart of the sub routine of the power on reset when supplying a power supply to this zoom camera.
[0033] In drawing, if a cell is inserted or the power switch POWER is switched, power on reset will start CPU101 and operation of a camera will be started. If the sub routine of this power on reset is called, after initial setting of RAM in each port and CPU101 is first performed at Step S101, the check judging of whether the automatic regulation machine 120 was connected to CPU101 will be performed at Step S102. As a result of this check, if the automatic regulation machine 120 is connected to CPU101, it will progress to Step S103 and communication with an external device will be performed. Moreover, if the above-mentioned automatic regulation machine 120 is not connected to CPU101, it progresses to Step S104 immediately, and a dc-battery check is performed. Here, when battery voltage is inadequate, while displaying those without a cell on the LCD panel 102, all camera operation is forbidden.
[0034] Then, in Step S105, after reading predetermined data from EEPROM106, the power switch POWER is checked at Step S106. Here, if the power switch POWER is off, it will progress to Step S120 and the display of the LCD panel 102 will be eliminated, and after the switches BK and RW which perform opening and closing and compulsive rewinding interrupting and granting a permission, it changes into a stop mode state. [of a back swine] If the power switch POWER is ON at the above-mentioned step S106, a zoom lens will be moved to the wide end position which can be photoed from a collapsing position at Step S113. And after progressing to Step S114 and displaying predetermined information on the LCD panel 102, stroboscope charge is performed at Step S115, and it considers as the state which can be photoed.
[0035] At Step S116, the display time to the LCD panel 102 is set to 90 seconds. And if a user operates a certain step, the timer for 90 seconds will be set again. After progressing to Step S118 and permitting interruption of open/close switch BK of a back swine, the rewinding switch RW, and other operation switches (henceforth KEY) to it if it had not passed to Step S119 when it progressed to Step S117, it judged whether 90 seconds passed and 90 seconds had passed, it changes into a halt mode state. When the switch with which interruption was permitted in the above-mentioned stop mode state and the halt mode state is pushed, the sub routine of the standby release shown in drawing 6 is performed.
[0036] Next, the sub routine of this standby release is explained with reference to the flow chart of drawing 6 .
[0037] First, interruption by the back swine switch BK is checked at Step S121. Here, if there is interruption by this back swine switch BK, it will be judged whether it progressed to Step S122 and the back swine has closed. After processing which progresses to Step S124 and opens a back swine at this step S122 if the back swine has not closed is performed, it returns to "1" of drawing 5 . Moreover, if the back swine has closed, after carrying out rapid-winding processing at Step S123, it returns to the above "1."
[0038] At Step S125, it rewinds and interruption by Switch RW is checked. Here, if there is interruption by this rewinding switch RW, it will progress to Step S127 and a film will be rewound.
[0039] Timer interruption is checked at Step S128. If there is timer interruption here, after progressing to Step S134 and performing display timer count processing, the strength of the light is measured at Step S135, and it returns to "2" of drawing 5 . When it is not timer interruption at the above-mentioned step S128, it progresses to Step S129 and film rewinding end or rapid-winding failure is checked. Here, if it is a film rewinding end or rapid-winding failure, it returns to "1" of drawing 5 so that a camera may not operate. Moreover, if it is not a film rewinding end or rapid-winding failure, it will progress to Step S130. If it is ON, the state of the power switch POWER is checked at this step S130, and if off, it progresses to the above "1", and it progresses to Step S131, and continues a main flow as it is.
[0040] The judgment of interruption by Above KEY is performed at the above-mentioned step S131. If after-mentioned each mode switch is pushed and interruption occurs, it will fly to "3" of drawing 7 , and if there is no interruption, it will progress to Step S132.
[0041] At the above-mentioned step S132, if a certain information confirms whether to be under [display] ****** on the LCD panel 102 and does not display [be / it] on it, it progresses to Step S133, interruption of KEY(s), such as each operation switches BK and RW, is permitted, and it will be in a stop mode state. If the LCD panel 102 expresses [be / it] as the

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above-mentioned step S132, it returns to "2" of drawing 5 .

[0042] In addition, the switch in the switch control unit 103 indicated to be KEY in Step S117, Step S131, and Step S133 to drawing 4 is meant.

[0043] Next, the sub routine of processing of the above-mentioned KEY interruption is explained with reference to drawing 7 .

[0044] If there is KEY interruption at the above-mentioned step SS 131 (refer to drawing 6), it progresses to Step S141 of drawing 7 , and the LCD panel 102 (refer to drawing 4) is turned on. Then, it is confirmed whether progress to Step S143 and the 1st step of release switch 1R is pushed. If the 1st step of this release switch 1R is pushed, after performing release processing in Step S144, it will return to "1" of drawing 5 . If the 1st step of release switch 1R is off, it progresses to Step S146 at the above-mentioned step S143 and directions of a zoom rise or a zoom down are made, it will progress to Step S158. At this step S158, if the LCD panel 102 confirms whether to be under [display] ****** and displays, if it is not [be / it] under display, it will return to "2" of drawing 5 "4" of drawing 6 again.

[0045] In the above-mentioned step S146, when there are directions of a zoom rise or a zoom down, it progresses to Step S147 and zoom processing is made.

[0046] Next, the step in Step S113 of above-mentioned drawing 5 which moves a zoom lens to the wide end position which can be photoed from a collapsing position is explained in more detail with reference to the flow chart and drawing 10 of drawing 8 .

[0047] In Step S301, after rotating the zoom motor 31 (refer to drawing 4) normally, A/D conversion of the output signal of the above-mentioned photograph reflector 11 (refer to ZPR and drawing 4) is carried out at Step S302. Then, in Step S303, predetermined threshold #TH1 is subtracted from this A/D-conversion value.

[0048] Then, the comparison value in the above-mentioned step S303 is judged (CY), in Step S304, if a borrow does not come out, the above-mentioned A/D value are higher than above-mentioned threshold #TH1, i.e., the output signal of the photograph reflector 11 judges it as "H" level, and it returns to Step S302. If the above-mentioned A/D value become lower than threshold #TH1, it will judge that the output signal of the photograph reflector 11 was set to "L" level, and will progress to Step S305.

[0049] When the output value of the above-mentioned photo interrupter 34 (refer to ZPI and drawing 4) is checked (ZPIHRD) and there is a standup edge at Step S306 by this step S305 after resetting ZMPLS on RAM of the CPU101 interior which shows the current value of a zoom lens, Above ZMPLS is carried out +one.

[0050] Then, since it will be wide end position if it returns to the above-mentioned step S306 and there is no borrow, since it still will not be wide end position if value #WIDE which shows wide end position is subtracted from the current value ZMPLS of a zoom lens, a comparison value is judged in Step S308 (CY) and there is a borrow at Step S307, it progresses to Step S309.

[0051] At this step S309, after applying brakes to the zoom motor 31 (ZMOTBK) and carrying out fixed time standby in Step S310, the zoom motor 31 is stopped in (TI) and Step S311, and it returns to a main routine (Step S312).

[0052] Next, the zoom processing in the above-mentioned step S147 is explained with reference to the flow chart of drawing 9 .

[0053] At a step SS 501, port initialization of CPU101 (refer to drawing 4) required for a zoom motor drive and starting of IFIC111 are performed. Then, in Step S502, if the flag ZUDF which shows the driving direction of the zoom motor 31 (refer to drawing 4) is seen and it becomes this flag ZUDF=1, it will progress to Step S504 so that the zoom motor 31 may be rotated normally. In the above-mentioned step S502, at the time of flag ZUDF=0, it progresses to a step SS 503 so that this zoom motor 31 may be reversed.

[0054] Then, in Step S511, it confirms whether it was turned on any of the zoom switch ZSW, i.e., aforementioned switch Z-UP for a zoom rise and switch Z-DOWN for a zoom down, they are (creatine kinase), and if this zoom switch ZSW is all off, it will progress to Step S516.

[0055] When it is turned on at the above-mentioned step S511 any of switch Z-UP for a zoom rise and switch Z-DOWN for a zoom down they are, it progresses to Step S512.

[0056] At this step S512, it judges whether the zoom position turned into wide end position or tele end position by the above ZMPLS which shows the current value of a zoom lens, and the above-mentioned zoom motor 31 is progressed to the halt way step S516 in the place which became one of the wide end-position and tele end position. Moreover, at the above-mentioned step S512, when the zoom lens position has not reached wide end position or tele end position, next, it progresses to Step S513.

[0057] At this step S513, during the usual zoom operation, although the output signal of the above-mentioned photograph reflector 11 (ZPR) is "L" level, when set to "H" level during a zoom drive, it judges it as an incorrect count and resets Above ZMPLS. Moreover, when the output signal of this photograph reflector 11 (ZPR) is set to "H" level during a zoom down, the zoom motor 31 is rotated normally, and if zoom processing mentioned above is performed, it can reset. Moreover, the pulse for value #TELE which shows tele end position in the place where the output signal of this photograph reflector 11 (ZPR) became "H" level exceeding threshold #TH2 (refer to drawing 11) is counted at the time of a zoom rise, and it resets Above ZMPLS to the pulse number equivalent to tele end position.

[0058] Then, the timer for detection of a photo interrupter 34 (ZPI) is started at Step S514, at Step S515, the pulse standup of this photo interrupter 34 is checked, and Above ZMPLS is counted up or counted down. Here, within fixed time, if there is no standup of this photo interrupter 34, it will be judged as failure of the zoom motor 31 or the zoom encoder 10, and will go to

exception processing (DAMAG) of Step S521.
[0059] If the above-mentioned step S516 judges the above-mentioned flag ZUDF and it becomes ZUDF=0, it will progress to Step S517.
[0060] This step S517 performs backlash **** of a gear by on the other hand driving a mechanism to **. When the zoom motor 31 is normally rotated as an amount of drives and standup 1 pulse of a photo interrupter 34 arises, this motor 31 is suspended.
[0061] Then, fixed time brakes are applied to the above-mentioned zoom motor 31 at Step S518 (ZMMOTB), and after stopping this zoom motor 31 at Step S519, it returns to a main routine (Step S520).
[0062] Drawing 12 shows the 2nd example of this invention, and this zoom encoder 210 is applied to the zoom lens lens-barrel of a camera. The inclination-cam-die slotted hole 213,214 for moving the built-in zoom lens group 211 which consists of pre-group lenses, such as barricade ETA, and back group lenses, such as a compensator, in the direction of an optical axis is drilled by the cam ring 212 which consists of a cam cylinder for a zoom lens drive. The guide pin 216,217 which stood erect in one, respectively is fitted in the pre-group lens maintenance frame and back group lens maintenance frame which are not illustrated at this cam slotted hole 213,214.
[0063] The sector reduction gear 219 for a ring drive is formed for the main part 215 of a camera of the above-mentioned cam ring 212 in the peripheral face of the base approach of ** at one at the hoop direction, and the reduction gear 218 for a drive has geared to this sector reduction gear 219. The turning effort of the output reduction gear 221 of a motor 220 is transmitted to this reduction gear 218 for a drive through a speed reducing gear train 222. Therefore, if the above-mentioned motor 220 is rotated normally or inversion driven, the turning effort will be transmitted to the reduction gear 218 for a drive through a speed reducing gear train 222. this -- a cam ring 212 -- the surroundings of an optical axis -- the right direction or an opposite direction -- rotating -- the above-mentioned cam groove -- by the hole 213,214 and the guide pin 216,217 A pre-group lens maintenance frame and a back group lens maintenance frame move in the direction of an optical axis so that the interval of a pre-group lens and a back group lens may be changed, and zooming of a zoom taking lens is made by this.
[0064] Moreover, to the above-mentioned reduction gear 218 for a drive, the reduction gear 225 for carrying out the rotation drive of the rotor plate 224 for pulse generating of a pulse generator 223 has geared. The above-mentioned pulse generator 223 consists of photo interrupters 226 which consist of the optical irradiation section by which it was countered and arranged in the circumferencial direction on both sides of a part of above-mentioned rotor plate 224 in which the translucent part formed so that a large number might begin to be prolonged in the ****** radiation direction at equal intervals, and the shading section were formed by turns, and this rotor plate 224, and a light sensing portion. Rotation of the reduction gear 218 for a drive which carries out the rotation drive of the above-mentioned cam ring 212 is interlocked with, a rotor plate 224 rotates, and this pulse generator 223 outputs the pulse signals P and I which answer rotation of a cam ring 212 with a photo interrupter 226.
[0065] And the pattern 130 for reading for absolute value encoders is formed in a part of peripheral face of the above-mentioned cam ring 212. This pattern 130 for reading is formed by the pattern of the shape of toothing of the heights of the high reflection factor section, and the crevice of the non-reflecting section, in the **** 2 example, makes the peripheral face of the cam ring itself heights, and forms it by the hole which drilled the crevice in the cam ring. Namely, as the flat-surface configuration is expanded and shown in drawing 13 , this pattern 130 for reading The crevice which the whole configuration becomes a hoop direction from an oblong rectangle, and consists of hole 130a drilled in the left section in the shape of L character, and hole 130b drilled in the method top half section of the right in the shape of an angle hole, It is prepared in the center section and formed by the heights which consist of high reflection factor section 131b formed in the position which forms successively to high reflection factor section 131a and said high reflection factor section 131a which countered the above-mentioned hole 130a and were formed in inverse L-shaped, and counters the above-mentioned hole 130b.
[0066] Thus, it is the position which counters the formed pattern 130 for reading, i.e., the outside of a cam ring 212, and as shown in the position which counters the above-mentioned pattern 130 for reading at drawing 12 , the photograph reflectors 132a and 132b are being fixed to the immobility member which is located in a line in the direction of an optical axis, and is not illustrated. And these photograph reflectors (P. R) 132a and 132b generate the output signals PR1 and PR2 of an absolute value encoder.
[0067] That is, as these photograph reflectors 132a and 132b are shown in drawing 13 , the output signals PR1 and PR2 change [rotation / of a cam ring 212] with ->(1.1) (0.1) ->(0.0) -> (1.0).
Here, standard position (S position) O (0.0) and the changing point of (1.0) are set [the changing point of (1.1) and (0.1) / between collapsing position O (0.1) and (0.0)] up for wide edge (wide angle edge) position O (0.1) and the changing point of (0.0) as tele edge (looking far) position O, respectively. In addition, the zoom lens whose zoom scale factor is 35mm - 80mm in this example shall be used, and it becomes 35mm at a wide edge (W end position), and becomes the focal distance of 80mm at a tele edge (T end position).
[0068] Drawing 14 shows the composition of the important section of the electrical circuit of the camera with which the above-mentioned zoom encoder was applied. Each actuating signal of the power switch PWSW, the switch ZUSW for a zoom rise, and the switch ZDSW for a zoom down inputs, respectively, and in CPU133 which carries out sequence control of zooming operation and photography operation of a camera, CPU133 controls the motor drive circuit 134 by these signals, and controls rotation of the aforementioned drive motor 220 by them to it. And the monitor of the output signals PR1 and PR2 of pulse signal P.I of the pulse generator 223 outputted by rotation of the aforementioned cam ring 212 and the above-mentioned

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photograph reflectors 132a and 132b is carried out, respectively. In addition, the pulse number "40" which shows the pulse number "10" and S position which show wide end position to the storage element 135 which consists of an EEPROM is memorized.

[0069] Next, operation of a zoom lens which has the zoom encoder of this example constituted in this way is explained with the flow chart shown in drawing 15 - drawing 18 . First, if a camera is power switched [PWSW] off, CPU133 will detect this, will surely set a zoom lens to a collapsed state, and will stop camera operation. That is, when the collapsing routine shown in drawing 15 is described, as the collapsing field in a lens barrel was shown in aforementioned drawing 13 , the outputs PR1 and PR2 of the photograph reflectors 132a and 132b are the fields of PR 1= 1 and PR 2= 1. Therefore, when the power switch PWSW is turned off, CPU133 is input port P.R.1 and P.R.2, giving inversion instructions of a zoom motor to the motor drive circuit 134, and reversing a motor 220 in Step S1. It is made to reverse until it is set to 1 both, and this is checked (Step S2). And when this is set [both] to 1, motor halt instructions are given to the motor drive circuit 134, and the return of the rotation of the zoom motor 220 is stopped and (Step S3) carried out. A zoom lens is set now to a collapsing position.

[0070] Next, if the power switch PWSW is turned on, as shown in drawing 16 , a power-on routine will operate, and CPU133 will set a zoom taking lens to a delivery position with a focal distance of 35mm which is a wide edge W position from a collapsed state. That is, when the power switch PWSW is turned on, CPU133 is input port P.R.1 and P.R.2, giving normal rotation instructions (Step S11) of a zoom motor to the motor drive circuit 134, and rotating the zoom motor 220 normally first. Carrying out a monitor (Step S12) is continued. And if a taking lens moves to the position set to output P.R.1 =0 and P.R.2 =1 from the collapsed state position of output P.R.1 =1 and P.R.2 =1, synchronizing with this, CPU133 starts the rise count of pulse signal P.I from a pulse generator 223 (Step S13), will be Step S14 and will check this counted value. And rotation of a motor is continued until it reaches the pulse number "10" which shows the wide end position currently written in EEPROM135 (refer to drawing 14). In the place which reached the pulse number "10" of a schedule, it is made to stop (Step S15) and the return of the rotation of the zoom motor 220 is carried out. A zoom lens is set now as a wide edge W position with a focal distance of 35mm from a collapsed state.

[0071] Subsequently, if a photography person turns on the switch ZUSW for a zoom rise and performs zoom rise operation, ZU routine shown in drawing 17 will operate. If the above-mentioned switch ZUSW is turned on, CPU133 will confirm whether be in tele end position (T end position) first by the outputs PR1 and PR2 of the photograph reflectors 132a and 132b (Step S21). If it is in tele end position (T end position), it will shift to Step S28, halt processing will be performed by the zoom motor halt routine, and the return of the rise count of pulse signal P.I from a pulse generator 223 will be stopped and (Step S29) carried out.

[0072] If there is nothing to tele end position (T end position), it will shift to the following step S22, and the rise count of pulse signal P.I will be started. And the zoom motor 220 is normally rotated at Step S23. CPU133 is input port P.R.1 and P.R.2, continuing a rise count in the meantime. A monitor is carried out and the monitor (Step S25) of change (Step S24) of outputs PR1 and PR2 and the state of the switch ZUSW for a zoom rise is carried out. If a photography person will determine a desired zoom position if this switch ZUSW turns off namely, it will fly to Step S28, the zoom motor 220 will be suspended, and the return of the rise count of pulse signal P.I will be stopped and (Step S29) carried out. And if there is change (Step S24) of outputs PR1 and PR2 between them, S position or T end position will be checked in Step S26, if it is T end position, it will fly to Step S28, and the zoom motor 220 is suspended, and the return of the rise count of pulse signal P.I is stopped and (Step S29) carried out. Moreover, if it is S position, the counted value of P.I will be set to "40" in Step S27, and it will return to Step S24. It means that setting counted value to the above-mentioned value here had updated counted value, and it can make future counted value exact. Thus, the encoder at the time of zoom rise operation operates.

[0073] Next, if a photography person pushes the switch ZDSW for a zoom down and performs zoom down operation, ZD routine shown in drawing 18 will operate. If the above-mentioned switch ZDSW is turned on, CPU133 will detect it and the counted value of the present P.I will check first whether it is below the pulse number "10" of wide end position (Step S31). Consequently, with "10", it flies to Step S38. [below] If it is not a wide edge, since a lens is in the position of the zoom rise direction, a lens is moved in the zoom down direction. That is, the down count of P.I is made to start (Step S32), and the zoom motor 220 is reversed (Step S33). The monitor (Step S37) of change (Step S34) of outputs PR1 and PR2 and the state of the switch ZDSW for a zoom down is carried out continuing a down count in the meantime. And Switch ZDSW is turned off when a lens moves to the zoom position for which a photography person asks. If this switch ZDSW for a zoom down turns off, the zoom motor 220 will be normally rotated for backlash **** of a reduction gear (Step S38). P. The rise count (Step S39) of I is performed. Predetermined rise count (Step S40), For example, after 2 rise counts, the zoom motor 220 is suspended (Step S41), the count of pulse signal P.I is stopped (Step S42), and the return of the one count for backlash is subtracted and (Step S43) carried out from the counter of P.I. Moreover, in Step S37, if Switch ZDSW turns on, the loop which returns to Step S34 will be taken.

[0074] If there is change of outputs PR1 and PR2 in Step S34, next, the check of being S position will be performed at Step S35, on the other hand, if it is S position, the count of P.I will be set to "40+(part for backlash 1) =41" which shows S position in Step S36, and it returns to Step S31. Thus, it means that setting counted value to the above-mentioned value had updated counted value, and it makes future counted value exact. Thus, the encoder at the time of zoom down operation operates.

[0075]

[Effect of the Invention] Like, without causing enlargement of composition, and a cost rise according to this invention, since the mistake count which is the theoretic fault which was described above, and which a relative-value encoder has is also

automatically corrected on rise/down operation way of zoom, the relative-value non-contact type zoom encoder which reliability is remarkable and improved can be offered.

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TECHNICAL FIELD

[Industrial Application] This invention relates to a zoom encoder and the zoom encoder used for the focal distance detection equipment of zoom photography optical system, such as a camera, in more detail.

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PRIOR ART

[Description of the Prior Art] As everyone knows, the zoom encoder which detects the amount of rotation and the rotation direction of the cam ring to which the focal distance of photography optical system is changed is used for the focal distance detection equipment of the zoom photography optical system in a camera etc. by rotating around the optical axis of photography optical system.

[0003] In order to detect the rotation position of the cam ring which performs zooming by rotation, this zoom encoder forms a several bits code board, contacts a brush to this code board, and it is made to detect the rotation position of a cam ring. It has the following faults, although there is an advantage that the detection means of a rotation position with this code board can detect the rotation position of a cam ring as bit information from a code board. That is, the manufacturing cost of 1 code board is high.

2) Since bit information has been acquired by contact of a code board and a brush, the defective continuity by oxidization of a code board front face and a brush side occurs with time.

3) The defective continuity by the shortage of contact pressure, surface wear, etc. occurs with time.

It will say that a defect occurs that a defect occurs with time like especially the above 2 and 3 among such faults, after crossing to a user's hand, and it poses a very serious problem on the quality of a product.

[0004] Therefore, in order to solve the fault of the above 2 and 3 fundamentally, it is possible to change into a non-contact type absolute value encoder like the magnetic formula which used optical or MR element etc. which used a zoom encoder of a contact process which was mentioned above for the photograph reflector etc. However, this means has the space of an encoder, and a conversely large demerit on cost. At most 2 - the triplet of expanding and the more it being thought that it is possible practically, the more this demerit enlarges resolution of a zoom encoder are limitations.

[0005] Then, a means to ask for the rotation position of a cam ring is proposed by preparing the optical pulse generator which answers the rotation of a cam ring which performs zooming using the zoom encoder of the conventional contact process, and generates a pulse, and counting up or counting down the pulse output from this generator according to the hand of cut of the cam ring for zoom as indicated by JP,2-5130,U. According to this means, the zoom encoder of a high resolution can be obtained only with one photo interrupter.

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EFFECT OF THE INVENTION

[Effect of the Invention] Like, without causing enlargement of composition, and a cost rise according to this invention, since the mistake count which is the theoretic fault which was described above, and which a relative-value encoder has is also automatically corrected on rise/down operation way of zoom, the relative-value non-contact type zoom encoder which reliability is remarkable and improved can be offered.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] However, the rotation position detection equipment using the zoom encoder indicated by above-mentioned JP,2-5130,U is the so-called relative-value encoder, and since it is not an absolute value encoder in a digital code like before, it has the following troubles theoretically.
(1) When a mistake count occurs by the incorrect pulse generated in the chatter ring of a pulse generator etc., it remains making a mistake, even if it changed the zoom state. Especially, in a non-contact type pulse generator, since an incorrect pulse occurs in the during starting of a zoom motor well, while making it carry out both-way movement of the zoom ring several times, a mistake count will be accumulated by it and it will have a serious bad influence for exposure and bit information as a result on it.
(2) Although the zoom value changed when the user pushed in or pulled the lens barrel, for example since the monitor of the output of a pulse generator was not necessarily carried out always, in the case of a camera etc., it cannot be detected, but after the zoom value has differed from the actual state, photography will be carried out to it, and it will have a serious bad influence for exposure and bit information as a result on it.
[0007] The purpose of this invention is to offer the non-contact type zoom encoder which is comparatively easy composition and is the theoretic fault which a relative-value encoder has and which can almost abolish practically the probability of occurrence of the trouble of the above (1) and (2), without causing enlargement of the composition by making non-contact the above-mentioned conventional absolute value encoder, and a cost rise.

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MEANS

[Means for Solving the Problem] In the zoom encoder which detects the amount of rotation and the rotation direction of the cam ring to which the focal distance of photography optical system is changed by rotating around the optical axis of photography optical system as the encoder by this invention is shown in the conceptual diagram of drawing 1 O A non-contact type pulse generating means 2 to generate a pulse signal according to rotation of the above-mentioned cam ring which is the driving means 1 to which the focal distance of photography optical system is changed, With a count means 3 to respond in the rotation direction of the above-mentioned cam ring, and to add or subtract the above-mentioned pulse signal, it sets near a wide angle edge and near a tele edge a focal distance at least. A position detection means 4 to detect a position signal, and a counted value change means 5 to change the counted value of the above-mentioned count means 3 into a predetermined value according to change of the output of this position detection means 4, It is characterized by providing a zoom information detection means 6 to acquire zoom information by the output from the above-mentioned count means 3.

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OPERATION

[Function] If the mid-position of a zoom moving range is arrived at, the counted value of a count means will be updated regardless of the number of pulse counts till then by the counted value corresponding to the exact focal distance.

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EXAMPLE

[Example] Hereafter, the example of illustration explains this invention.
[0011] Drawing 2 shows the 1st example of this invention, and this zoom encoder 10 is applied to the zoom lens lens-barrel of a camera.
[0012] The zoom encoder 10 formed in the rotation ring 20 consists of three of the fields C exceeding the collapsing section A, the photography range section B, and tele end position, as shown in drawing 3 , among these silver or white with the high A section and C section, and the B section of a reflection factor serve as low black of a reflection factor. Furthermore, among drawing of drawing 2 , the above-mentioned rotation ring 20 rotates in the direction shown by sign A or I, and drives a zoom lens. And the output signal of the zoom photograph reflector 11 (ZPR) fixed to the position in the main part of a camera changes with rotation of this zoom encoder 10. Namely, when the above-mentioned photograph reflector 11 has met the position of alpha shown in drawing 3 , it is a collapsed state, and when this photograph reflector 11 has met the position of beta and the position of a wide state and gamma is met, it is in a tele state.
[0013] The zoom drive unit 30 The zoom motor 31 and the slowdown reduction-gear train 32, The slit 33 which is prepared on axial extension of the above-mentioned zoom motor 31, is interlocked with this zoom motor 31, and is rotated, The zoom photo interrupter 34 (ZPI) which is arranged near this slit 33 and generates an output signal according to rotation of this slit 33, It consists of output reduction gears 35 which gear to the last reduction gear of the above-mentioned slowdown reduction-gear train 32, gear with the drive reduction gear 21 prepared in the periphery of the above-mentioned rotation ring 20, and transmit the rotation force of the above-mentioned zoom motor 31 to the rotation ring 20.
[0014] In addition, the above-mentioned photograph reflector 11 and the outgoing end of a photo interrupter 34 are connected to CPU101 (refer to drawing 4) mentioned later, and CPU101 detects the present focal distance based on the output signal of this photograph reflector 11 and a photo interrupter 34.
[0015] Drawing 4 is the block schematic diagram of the zoom camera with which **** 1 example is applied.
[0016] In drawing, CPU101 is a microcomputer which controls operation of the above-mentioned whole zoom camera, and manages LCD [the sequence control of this zoom camera operation, auto-focusing / auto exposure (henceforth AF/AE) operation, A/D conversion,] / Light Emitting Diode control, and a switch input control.
[0017] the LCD panel 102 -- the piece of a film -- it is the liquid crystal display board which displays a number, a battery check result, etc., respectively
[0018] 1st step switch 1R which the switch control unit 103 operates when half-push [release **], and locks AF and AE, When turned on with 2nd step switch 2R for shutter release which operates when all push [release **], switch Z-UP for a zoom rise, and switch Z-DOWN for a zoom down The power-on switch POWER which the above CPU 101 displays on the above-mentioned LCD panel 102, and changes the whole zoom camera into the state which can be photoed It consists of a switch RW for compulsive rewinding [which performs rewinding under photography], and a back lid-open close switch BK which winds having shut the back lid rapidly by detecting.
[0019] Moreover, light emitting diode (IRED) and a sign 123 show a position sensor (PSD), and, as for a sign 124, IC (AFIC) for AF ranging in the inside of drawing and a sign 105 and a sign 122 show a photographic subject. The above AFIC105 floodlights infrared light for a photographic subject 124 based on the control signal from the above CPU 101, and ranges by detecting the reflected light by PSD123. And the obtained ranging data are transmitted to CPU101 through a serial data bus.
[0020] EEPROM106 is eliminable ROM electrically and has memorized various adjustment values, such as the number of film **, **** correction value stroboscope charge voltage information, and battery check information.
[0021] The stroboscope unit 108 will start charge, if a charge signal is given from the above CPU 101, charge voltage is sent to this CPU101, after A/D conversion is carried out, it is compared with the charge voltage information on EEPROM106, and it is confirmed whether to be the completion of charge.
[0022] The Light Emitting Diode display 109 is a display which tells a photography person about stroboscope luminescence warning, AF lock, etc.
[0023] IF-IC111 is constituted from an IC for an interface by the Light Emitting Diode drive circuit, the circuit which measures the strength of the light by SPD110, the motor drive circuit, the reference voltage circuit, etc.
[0024] Both the signs 112,113 are supplied to this IC112,113 for a drive, after the motorised signal which is IC for motorised and is sent out from the above CPU 101 is once decoded within above-mentioned IF-IC111. And which motor of the above-mentioned zoom motor 31, the AF motor 115, winding up, and the rewinding motor 116 is chosen by the signal of CPU101, and it drives.

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[0025] Near the above-mentioned AF motor 115, the photo interrupter 126 which is interlocked with rotation of this motor 115 and generates an output signal is formed, and the above CPU 101 performs rotation control of this AF motor 115 based on the output of this photo interrupter 126.
[0026] Near the above-mentioned winding and the rewinding motor 116, similarly, the photo interrupter 127 which is interlocked with rotation of this motor 116 and generates an output signal is formed, and, as for the above CPU 101, rotation control of this motor 116 is performed based on the output of this photo interrupter 127.
[0027] The above-mentioned zoom motor 31 is controlled by CPU101 based on the output signal of a photo interrupter 34 and the photograph reflector 11, as mentioned above.
[0028] The automatic regulation material 120 is used as a checker at the time of performing AF, AE, battery check, stroboscope adjustment, etc. at works. Each of this data is sent to CPU101 through a serial data bus, and memorizes an adjustment value to the above EEPROM 106.
[0029] The DX code 150 of a film is directly read into CPU101, and is used as an operation value for deciding exposure value.
[0030] A sign 121 is a plunger for sector opening and closing, and a sign 125 is a detecting element which applies reset to CPU101 by the detecting element of a cell voltage at the time of a cell injection and returns of failed voltage.
[0031] Next, an operation of the zoom camera with which **** 1 example is applied is explained with reference to the flow chart shown in drawing 5 - drawing 8 .
[0032] Drawing 5 is the flow chart of the sub routine of the power on reset when supplying a power supply to this zoom camera.
[0033] In drawing, if a cell is inserted or the power switch POWER is switched, power on reset will start CPU101 and operation of a camera will be started. If the sub routine of this power on reset is called, after initial setting of RAM in each port and CPU101 is first performed at Step S101, the check judging of whether the automatic regulation machine 120 was connected to CPU101 will be performed at Step S102. As a result of this check, if the automatic regulation machine 120 is connected to CPU101, it will progress to Step S103 and communication with an external device will be performed. Moreover, if the above-mentioned automatic regulation machine 120 is not connected to CPU101, it progresses to Step S104 immediately, and a dc-battery check is performed. Here, when battery voltage is inadequate, while displaying those without a cell on the LCD panel 102, all camera operation is forbidden.
[0034] Then, in Step S105, after reading predetermined data from EEPROM106, the power switch POWER is checked at Step S106. Here, if the power switch POWER is off, it will progress to Step S120 and the display of the LCD panel 102 will be eliminated, and after the switches BK and RW which perform opening and closing and compulsive rewinding interrupting and granting a permission, it changes into a stop mode state. [of a back pig] If the power switch POWER is ON at the above-mentioned step S106, a zoom lens will be moved to the wide end position which can be photoed from a collapsing position at Step S113. And after progressing to Step S114 and displaying predetermined information on the LCD panel 102, stroboscope charge is performed at Step S115, and it considers as the state which can be photoed.
[0035] At Step S116, the display time to the LCD panel 102 is set to 90 seconds. And if a user operates a certain step, the timer for 90 seconds will be set again. After progressing to Step S118 and permitting interruption of open/close switch BK of a back swine, the rewinding switch RW, and other operation switches (henceforth KEY) to it if it had not passed to Step S119 when it progressed to Step S117, it judged whether 90 seconds passed and 90 seconds had passed, it changes into a halt mode state. When the switch with which interruption was permitted in the above-mentioned stop mode state and the halt mode state is pushed, the sub routine of the standby release shown in drawing 6 is performed.
[0036] Next, the sub routine of this standby release is explained with reference to the flow chart of drawing 6 .
[0037] First, interruption by the back pig switch BK is checked at Step S121. Here, if there is interruption by this back pig switch BK, it will be judged whether it progressed to Step S122 and the back pig has closed. After processing which progresses to Step S124 and opens a back pig at this step S122 if the back pig has not closed is performed, it returns to "1" of drawing 5 . Moreover, if the back pig has closed, after carrying out rapid-winding processing at Step S123, it returns to the above "1."
[0038] At Step S125, it rewinds and interruption by Switch RW is checked. Here, if there is interruption by this rewinding switch RW, it will progress to Step S127 and a film will be rewound.
[0039] Timer interruption is checked at Step S128. If there is timer interruption here, after progressing to Step S134 and performing display timer count processing, the strength of the light is measured at Step S135, and it returns to "2" of drawing 5 . When it is not timer interruption at the above-mentioned step S128, it progresses to Step S129 and film rewinding end or rapid-winding failure is checked. Here, if it is a film rewinding end or rapid-winding failure, it returns to "1" of drawing 5 so that a camera may not operate. Moreover, if it is not a film rewinding end or rapid-winding failure, it will progress to Step S130. If it is ON, the state of the power switch POWER is checked at this step S130, and if off, it progresses to the above "1", and it progresses to Step S131, and continues a main flow as it is.
[0040] The judgment of interruption by Above KEY is performed at the above-mentioned step S131. If after-mentioned each mode switch is pushed and interruption occurs, it will fly to "3" of drawing 7 , and if there is no interruption, it will progress to Step S132.
[0041] At the above-mentioned step S132, if a certain information confirms whether to be under [display] ****** on the LCD panel 102 and does not display [be / it] on it, it progresses to Step S133, interruption of KEY(s), such as each operation switches BK and RW, is permitted, and it will be in a stop mode state. If the LCD panel 102 expresses [be / it] as the

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above-mentioned step S132, it returns to "2" of drawing 5 .
[0042] In addition, the switch in the switch control unit 103 indicated to be KEY in Step S117, Step S131, and Step S133 to drawing 4 is meant.
[0043] Next, the sub routine of processing of the above-mentioned KEY interruption is explained with reference to drawing 7 .
[0044] If there is KEY interruption at the above-mentioned step SS 131 (refer to drawing 6), it progresses to Step S141 of drawing 7 , and the LCD panel 102 (refer to drawing 4) is turned on. Then, it is confirmed whether progress to Step S143 and the 1st step of release switch 1R is pushed. If the 1st step of this release switch 1R is pushed, after performing release processing in Step S144, it will return to "1" of drawing 5 . If the 1st step of release switch 1R is off, it progresses to Step S146 at the above-mentioned step S143 and directions of a zoom rise or a zoom down are made, it will progress to Step S158. At this step S158, if the LCD panel 102 confirms whether to be under [display] ****** and displays, if it is not [be / it] under display, it will return to "2" of drawing 5 "4" of drawing 6 again.
[0045] In the above-mentioned step S146, when there are directions of a zoom rise or a zoom down, it progresses to Step S147 and zoom processing is made.
[0046] Next, the step in Step S113 of above-mentioned drawing 5 which moves a zoom lens to the wide end position which can be photoed from a collapsing position is explained in more detail with reference to the flow chart and drawing 10 of drawing 8 .
[0047] In Step S301, after rotating the zoom motor 31 (refer to drawing 4) normally, A/D conversion of the output signal of the above-mentioned photograph reflector 11 (refer to ZPR and drawing 4) is carried out at Step S302. Then, in Step S303, predetermined threshold #TH1 is subtracted from this A/D-conversion value.
[0048] Then, the comparison value in the above-mentioned step S303 is judged (CY), in Step S304, if a borrow does not come out, the above-mentioned A/D value are higher than above-mentioned threshold #TH1, i.e., the output signal of the photograph reflector 11 judges it as "H" level, and it returns to Step S302. If the above-mentioned A/D value become lower than threshold #TH1, it will judge that the output signal of the photograph reflector 11 was set to "L" level, and will progress to Step S305.
[0049] When the output value of the above-mentioned photo interrupter 34 (refer to ZPI and drawing 4) is checked (ZPIHRD) and there is a standup edge at Step S306 by this step S305 after resetting ZMPLS on RAM of the CPU101 interior which shows the current value of a zoom lens, Above ZMPLS is carried out +one.
[0050] Then, since it will be wide end position if it returns to the above-mentioned step S306 and there is no borrow, since it still will not be wide end position if value #WIDE which shows wide end position is subtracted from the current value ZMPLS of a zoom lens, a comparison value is judged in Step S308 (CY) and there is a borrow at Step S307, it progresses to Step S309.
[0051] At this step S309, after applying brakes to the zoom motor 31 (ZMOTBK) and carrying out fixed time standby in Step S310, the zoom motor 31 is stopped in (TI) and Step S311, and it returns to a main routine (Step S312).
[0052] Next, the zoom processing in the above-mentioned step S147 is explained with reference to the flow chart of drawing 9 .
[0053] At a step SS 501, port initialization of CPU101 (refer to drawing 4) required for a zoom motor drive and starting of IFIC111 are performed. Then, in Step S502, if the flag ZUDF which shows the driving direction of the zoom motor 31 (refer to drawing 4) is seen and it becomes this flag ZUDF=1, it will progress to Step S504 so that the zoom motor 31 may be rotated normally. In the above-mentioned step S502, at the time of flag ZUDF=0, it progresses to a step SS 503 so that this zoom motor 31 may be reversed.
[0054] Then, in Step S511, it confirms whether it was turned on any of the zoom switch ZSW, i.e., aforementioned switch Z-UP for a zoom rise and switch Z-DOWN for a zoom down, they are (CK), and if this zoom switch ZSW is all off, it will progress to Step S516.
[0055] When it is turned on at the above-mentioned step S511 any of switch Z-UP for a zoom rise and switch Z-DOWN for a zoom down they are, it progresses to Step S512.
[0056] At this step S512, it judges whether the zoom position turned into wide end position or tele end position by the above ZMPLS which shows the current value of a zoom lens, and the above-mentioned zoom motor 31 is progressed to the halt way step S516 in the place which became one of the wide end-position and tele end position. Moreover, at the above-mentioned step S512, when the zoom lens position has not reached wide end position or tele end position, next, it progresses to Step S513.
[0057] At this step S513, during the usual zoom operation, although the output signal of the above-mentioned photograph reflector 11 (ZPR) is "L" level, when set to "H" level during a zoom drive, it judges it as an incorrect count and resets Above ZMPLS. Moreover, when the output signal of this photograph reflector 11 (ZPR) is set to "H" level during a zoom down, the zoom motor 31 is rotated normally, and if zoom processing mentioned above is performed, it can reset. Moreover, the pulse for value #TELE which shows tele end position in the place where the output signal of this photograph reflector 11 (ZPR) became "H" level exceeding threshold #TH2 (refer to drawing 11) is counted at the time of a zoom rise, and it resets Above ZMPLS to the pulse number equivalent to tele end position.
[0058] Then, the timer for detection of a photo interrupter 34 (ZPI) is started at Step S514, at Step S515, the pulse standup of this photo interrupter 34 is checked, and Above ZMPLS is counted up or counted down. Here, within fixed time, if there is no standup of this photo interrupter 34, it will be judged as failure of the zoom motor 31 or the zoom encoder 10, and will go to

exception processing (DAMAG) of Step S521.
[0059] If the above-mentioned step S516 judges the above-mentioned flag ZUDF and it becomes ZUDF=0, it will progress to Step S517.
[0060] This step S517 performs backlash **** of a gear by on the other hand driving a mechanism to **. When the zoom motor 31 is normally rotated as an amount of drives and standup 1 pulse of a photo interrupter 34 arises, this motor 31 is suspended.
[0061] Then, fixed time brakes are applied to the above-mentioned zoom motor 31 at Step S518 (ZMMOTB), and after stopping this zoom motor 31 at Step S519, it returns to a main routine (Step S520).
[0062] Drawing 12 shows the 2nd example of this invention, and this zoom encoder 210 is applied to the zoom lens lens-barrel of a camera. The inclination-cam-die slotted hole 213,214 for moving the built-in zoom lens group 211 which consists of pre-group lenses, such as barricade ETA, and back group lenses, such as a compensator, in the direction of an optical axis is drilled by the cam ring 212 which consists of a cam cylinder for a zoom lens drive. The guide pin 216,217 which stood erect in one, respectively is fitted in the pre-group lens maintenance frame and back group lens maintenance frame which are not illustrated at this cam slotted hole 213,214.
[0063] The sector reduction gear 219 for a ring drive is formed for the main part 215 of a camera of the above-mentioned cam ring 212 in the peripheral face of the base approach of ** at one at the hoop direction, and the reduction gear 218 for a drive has geared to this sector reduction gear 219. The turning effort of the output reduction gear 221 of a motor 220 is transmitted to this reduction gear 218 for a drive through a speed reducing gear train 222. Therefore, if the above-mentioned motor 220 is rotated normally or inversion driven, the turning effort will be transmitted to the reduction gear 218 for a drive through a speed reducing gear train 222. this -- a cam ring 212 -- the surroundings of an optical axis -- the right direction or an opposite direction -- rotating -- the above-mentioned cam groove -- by the hole 213,214 and the guide pin 216,217 A pre-group lens maintenance frame and a back group lens maintenance frame move in the direction of an optical axis so that the interval of a pre-group lens and a back group lens may be changed, and zooming of a zoom taking lens is made by this.
[0064] Moreover, to the above-mentioned reduction gear 218 for a drive, the reduction gear 225 for carrying out the rotation drive of the rotor plate 224 for pulse generating of a pulse generator 223 has geared. The above-mentioned pulse generator 223 consists of photo interrupters 226 which consist of the optical irradiation section by which it was countered and arranged in the circumferencial direction on both sides of a part of above-mentioned rotor plate 224 in which the translucent part formed so that a large number might begin to be prolonged in the ****** radiation direction at equal intervals, and the shading section were formed by turns, and this rotor plate 224, and a light sensing portion. Rotation of the reduction gear 218 for a drive which carries out the rotation drive of the above-mentioned cam ring 212 is interlocked with, a rotor plate 224 rotates, and this pulse generator 223 outputs the pulse signals P and I which answer rotation of a cam ring 212 with a photo interrupter 226.
[0065] And the pattern 130 for reading for absolute value encoders is formed in a part of peripheral face of the above-mentioned cam ring 212. This pattern 130 for reading is formed by the pattern of the shape of toothing of the heights of the high reflection factor section, and the crevice of the non-reflecting section, in the **** 2 example, makes the peripheral face of the cam ring itself heights, and forms it by the hole which drilled the crevice in the cam ring. Namely, as the flat-surface configuration is expanded and shown in drawing 13 , this pattern 130 for reading The crevice which the whole configuration becomes a hoop direction from an oblong rectangle, and consists of hole 130a drilled in the left section in the shape of L character, and hole 130b drilled in the method top half section of the right in the shape of an angle hole, It is prepared in the center section and formed by the heights which consist of high reflection factor section 131b formed in the position which forms successively to high reflection factor section 131a and said high reflection factor section 131a which countered the above-mentioned hole 130a and were formed in inverse L-shaped, and counters the above-mentioned hole 130b.
[0066] Thus, it is the position which counters the formed pattern 130 for reading, i.e., the outside of a cam ring 212, and as shown in the position which counters the above-mentioned pattern 130 for reading at drawing 12 , the photograph reflectors 132a and 132b are being fixed to the immobility member which is located in a line in the direction of an optical axis, and is not illustrated. And these photograph reflectors (P. R) 132a and 132b generate the output signals PR1 and PR2 of an absolute value encoder.
[0067] That is, as these photograph reflectors 132a and 132b are shown in drawing 13 , the output signals PR1 and PR2 change [rotation / of a cam ring 212] with ->(1.1) (0.1) ->(0.0) -> (1.0).
Here, standard position (S position) O (0.0) and the changing point of (1.0) are set [the changing point of (1.1) and (0.1) / between collapsing position O (0.1) and (0.0)] up for wide edge (wide angle edge) position O (0.1) and the changing point of (0.0) as tele edge (looking far) position O, respectively. In addition, the zoom lens whose zoom scale factor is 35mm - 80mm in this example shall be used, and it becomes 35mm at a wide edge (W end position), and becomes the focal distance of 80mm at a tele edge (T end position).
[0068] Drawing 14 shows the composition of the important section of the electrical circuit of the camera with which the above-mentioned zoom encoder was applied. Each actuating signal of the power switch PWSW, the switch ZUSW for a zoom rise, and the switch ZDSW for a zoom down inputs, respectively, and in CPU133 which carries out sequence control of zooming operation and photography operation of a camera, CPU133 controls the motor drive circuit 134 by these signals, and controls rotation of the aforementioned drive motor 220 by them to it. And the monitor of the output signals PR1 and PR2 of pulse signal P.I of the pulse generator 223 outputted by rotation of the aforementioned cam ring 212 and the above-mentioned

photograph reflectors 132a and 132b is carried out, respectively. In addition, the pulse number "40" which shows the pulse number "10" and S position which show wide end position to the storage element 135 which consists of an EEPROM is memorized.

[0069] Next, operation of a zoom lens which has the zoom encoder of this example constituted in this way is explained with the flow chart shown in drawing 15 - drawing 18 . First, if a camera is power switched [PWSW] off, CPU133 will detect this, will surely set a zoom lens to a collapsed state, and will stop camera operation. That is, when the collapsing routine shown in drawing 15 is described, as the collapsing field in a lens barrel was shown in aforementioned drawing 13 , the outputs PR1 and PR2 of the photograph reflectors 132a and 132b are the fields of PR 1= 1 and PR 2= 1. Therefore, when the power switch PWSW is turned off, CPU133 is input port P.R.1 and P.R.2, giving inversion instructions of a zoom motor to the motor drive circuit 134, and reversing a motor 220 in Step S1. It is made to reverse until it is set to 1 both, and this is checked (Step S2). And when this is set [both] to 1, motor halt instructions are given to the motor drive circuit 134, and the return of the rotation of the zoom motor 220 is stopped and (Step S3) carried out. A zoom lens is set now to a collapsing position.

[0070] Next, if the power switch PWSW is turned on, as shown in drawing 16 , a power-on routine will operate, and CPU133 will set a zoom taking lens to a delivery position with a focal distance of 35mm which is a wide edge W position from a collapsed state. That is, when the power switch PWSW is turned on, CPU133 is input port P.R.1 and P.R.2, giving normal rotation instructions (Step S11) of a zoom motor to the motor drive circuit 134, and rotating the zoom motor 220 normally first. Carrying out a monitor (Step S12) is continued. And if a taking lens moves to the position set to output P.R.1 =0 and P.R.2 =1 from the collapsed state position of output P.R.1 =1 and P.R.2 =1, synchronizing with this, CPU133 starts the rise count of pulse signal P.I from a pulse generator 223 (Step S13), will be Step S14 and will check this counted value. And rotation of a motor is continued until it reaches the pulse number "10" which shows the wide end position currently written in EEPROM135 (refer to drawing 14). In the place which reached the pulse number "10" of a schedule, it is made to stop (Step S15) and the return of the rotation of the zoom motor 220 is carried out. A zoom lens is set now as a wide edge W position with a focal distance of 35mm from a collapsed state.

[0071] Subsequently, if a photography person turns on the switch ZUSW for a zoom rise and performs zoom rise operation, ZU routine shown in drawing 17 will operate. If the above-mentioned switch ZUSW is turned on, CPU133 will confirm whether be in tele end position (T end position) first by the outputs PR1 and PR2 of the photograph reflectors 132a and 132b (Step S21). If it is in tele end position (T end position), it will shift to Step S28, halt processing will be performed by the zoom motor halt routine, and the return of the rise count of pulse signal P.I from a pulse generator 223 will be stopped and (Step S29) carried out.

[0072] If there is nothing to tele end position (T end position), it will shift to the following step S22, and the rise count of pulse signal P.I will be started. And the zoom motor 220 is normally rotated at Step S23. CPU133 is input port P.R.1 and P.R.2, continuing a rise count in the meantime. A monitor is carried out and the monitor (Step S25) of change (Step S24) of outputs PR1 and PR2 and the state of the switch ZUSW for a zoom rise is carried out. If a photography person will determine a desired zoom position if this switch ZUSW turns off namely, it will fly to Step S28, the zoom motor 220 will be suspended, and the return of the rise count of pulse signal P.I will be stopped and (Step S29) carried out. And if there is change (Step S24) of outputs PR1 and PR2 between them, S position or T end position will be checked in Step S26, if it is T end position, it will fly to Step S28, and the zoom motor 220 is suspended, and the return of the rise count of pulse signal P.I is stopped and (Step S29) carried out. Moreover, if it is S position, the counted value of P.I will be set to "40" in Step S27, and it will return to Step S24. It means that setting counted value to the above-mentioned value here had updated counted value, and it can make future counted value exact. Thus, the encoder at the time of zoom rise operation operates.

[0073] Next, if a photography person pushes the switch ZDSW for a zoom down and performs zoom down operation, ZD routine shown in drawing 18 will operate. If the above-mentioned switch ZDSW is turned on, CPU133 will detect it and the counted value of the present P.I will check first whether it is below the pulse number "10" of wide end position (Step S31). Consequently, with "10", it flies to Step S38. [below] If it is not a wide edge, since a lens is in the position of the zoom rise direction, a lens is moved in the zoom down direction. That is, the down count of P.I is made to start (Step S32), and the zoom motor 220 is reversed (Step S33). The monitor (Step S37) of change (Step S34) of outputs PR1 and PR2 and the state of the switch ZDSW for a zoom down is carried out continuing a down count in the meantime. And Switch ZDSW is turned off when a lens moves to the zoom position for which a photography person asks. If this switch ZDSW for a zoom down turns off, the zoom motor 220 will be normally rotated for backlash **** of a reduction gear (Step S38). P. The rise count (Step S39) of I is performed. Predetermined rise count (Step S40), For example, after 2 rise counts, the zoom motor 220 is suspended (Step S41), the count of pulse signal P.I is stopped (Step S42), and the return of the one count for backlash is subtracted and (Step S43) carried out from the counter of P.I. Moreover, in Step S37, if Switch ZDSW turns on, the loop which returns to Step S34 will be taken.

[0074] If there is change of outputs PR1 and PR2 in Step S34, next, the check of being S position will be performed at Step S35, on the other hand, if it is S position, the count of P.I will be set to "40+(part for backlash 1) =41" which shows S position in Step S36, and it returns to Step S31. Thus, it means that setting counted value to the above-mentioned value had updated counted value, and it makes future counted value exact. Thus, the encoder at the time of zoom down operation operates.

[Translation done.]

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* NOTICES *

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damages caused by the use of this translation.

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The conceptual diagram of the zoom encoder of this invention.
[Drawing 2] The perspective diagram of the zoom encoder in which the 1st example of this invention is shown.
[Drawing 3] The diagram showing the relation of the pattern for reading of a photograph reflector and photograph reflector output in the 1st example of the above.
[Drawing 4] The block block diagram of the electrical circuit of the important section of the zoom encoder of the 1st example of the above.
[Drawing 5] The flow chart which shows the sub routine at the time of power on reset when switching on a power supply to the zoom camera with which the 1st example of the above is applied.
[Drawing 6] The flow chart which shows the sub routine at the time of standby release of the zoom camera with which the 1st example of the above is applied.
[Drawing 7] The sub routine **** flow chart of the switch operation **** interruption processing in the zoom camera with which the 1st example of the above is applied.
[Drawing 8] The flow chart which shows operation at the time of a zoom lens being moved to the wide end position which can be photoed from a collapsing position in the zoom camera with which the 1st example of the above is applied.
[Drawing 9] The flow chart which shows the zoom processing in the zoom camera with which the 1st example of the above is applied.
[Drawing 10] The timing diagram which showed the relation with the output signal of the zoom motor and zoom photograph reflector at the time of a zoom lens being moved to the wide end position which can be photoed from a collapsing position, and a zoom photo interrupter in the zoom camera with which the 1st example of the above is applied.
[Drawing 11] The timing diagram which showed the relation with the output signal of the zoom motor and zoom photograph reflector at the time of a zoom lens being moved to the tele end position which can be photoed from a collapsing position, and a zoom photo interrupter in the zoom camera with which the 1st example of the above is applied.
[Drawing 12] The perspective diagram of the zoom encoder in which the 2nd example of this invention is shown.
[Drawing 13] The diagram showing the relation of the pattern for reading of a photograph reflector and photograph reflector output in the 2nd example of the above.
[Drawing 14] The block block diagram of the electrical circuit of the important section of the zoom encoder of the 2nd example of the above.
[Drawing 15] The flow chart of the program of the collapsing routine of the zoom lens in the zoom camera with which the 2nd example of the above is applied.
[Drawing 16] The flow chart of the program of the power-on routine when power switching off the zoom camera with which the 2nd example of the above is applied.
[Drawing 17] The flow chart of the program of ZU routine when zoom rise switching off the zoom camera with which the 2nd example of the above is applied.
[Drawing 18] The flow chart of the program of ZD routine when zoom down switching off the zoom camera with which the 2nd example of the above is applied.
[Description of Notations]
1 -- Zoom driving means
2 -- Non-contact type pulse generating means
3 -- Pulse count means
4 -- Zoom predetermined position detection means
5 -- Renewal means of counted value
10 -- Zoom encoder
11 -- Zoom photograph reflector
20 -- Rotation ring
30 -- Zoom motor drive unit
31 -- Zoom motor
34 -- Zoom photo interrupter

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[Translation done.]

(19)日本国特許庁（ＪＰ）　(12)**公開特許公報（Ａ）**　(11)特許出願公開番号

特開平5－181050

(43)公開日　平成5年(1993)7月23日

(51)Int.Cl.[5]		識別記号	庁内整理番号	ＦＩ		技術表示箇所
Ｇ０２Ｂ	7/08		Ｃ			
	7/09					
Ｇ０３Ｂ	5/00		Ｚ	7513－2Ｋ		
				7811－2Ｋ	Ｇ０２Ｂ　7/11	Ｐ

審査請求　未請求　請求項の数2(全 22 頁)

(21)出願番号　特願平4－16677

(22)出願日　平成4年(1992)1月31日

(31)優先権主張番号　特願平3－288900

(32)優先日　平3(1991)11月5日

(33)優先権主張国　日本（ＪＰ）

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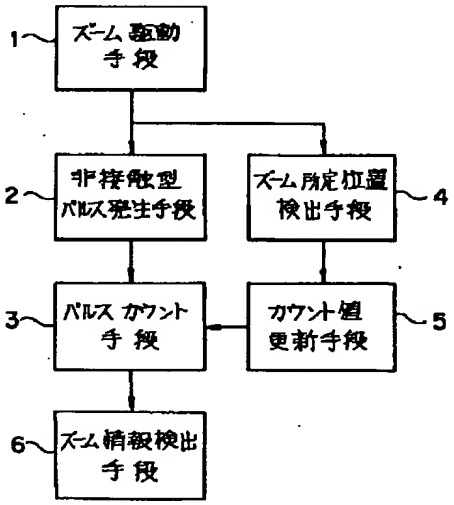
(54)【発明の名称】　ズームエンコーダ

(57)【要約】

【目的】本発明は、従来の絶対値エンコーダを非接触化することによる構成の大型化、並びにコストアップを招くことなく、比較的簡単な構成で、かつ相対値エンコーダのもつ原理的な欠点を実用上、殆ど無くすことのできる非接触型のズームエンコーダを提供するにある。

【構成】撮影光学系の光軸の周りに回動することにより撮影光学系の焦点距離を変化させるカムリングの、回動量および回動方向を検出するズームエンコーダにおいて、◎撮影光学系の焦点距離を変化させる駆動手段１である上記カムリングの回動に応じてパルス信号を発生する非接触型のパルス発生手段２と、上記カムリングの回動方向に応じて上記パルス信号を加算もしくは減算するカウント手段３と、少なくとも焦点距離の広角端付近と望遠端付近において、所定の位置信号を検出する位置検出手段４と、この位置検出手段４の出力の変化に応じて上記カウント手段３のカウント値を所定の値に変更するカウント値変更手段５と、上記カウント手段３からの出力によりズーム情報を得るズーム情報検出手段６とを具備したことを特徴とする。



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【特許請求の範囲】

【請求項1】撮影光学系の光軸の周りに回動することにより撮影光学系の焦点距離を変化させるカムリングの、回動量および回動方向を検出するズームエンコーダにおいて、

上記カムリングの回動に応じてパルス信号を発生する非接触型のパルス発生手段と、

上記カムリングの回動方向に応じて上記パルス信号を加算もしくは減算するカウント手段と、

少なくとも焦点距離の広角端付近と望遠端付近において、所定の位置信号を検出する位置検出手段と、

この位置検出手段の出力の変化に応じて上記カウント手段のカウント値を所定の値に変更するカウント値変更手段と、

を具備したことを特徴とするズームエンコーダ。

【請求項2】上記位置検出手段は、さらに上記焦点距離の広角端と望遠端との中間領域において、所定の中間位置を検出することを特徴とする、請求項1記載のズームエンコーダ。

【発明の詳細な説明】

【0001】

【産業上の利用分野】この発明は、ズームエンコーダ、更に詳しくは、カメラ等のズーム撮影光学系の焦点距離検出装置に用いられるズームエンコーダに関するものである。

【0002】

【従来の技術】周知のように、カメラ等におけるズーム撮影光学系の焦点距離検出装置には、撮影光学系の光軸の周りに回動することにより、撮影光学系の焦点距離を変化させるカムリングの、回動量および回動方向を検出するズームエンコーダが用いられている。

【0003】このズームエンコーダは回転によってズーミングを行うカムリングの回転位置を検出するために、数ビットのコード板を設け、このコード板にブラシを接触させてカムリングの回転位置を検出するようにしている。このコード板による回転位置の検出手段は、カムリングの回転位置をコード板からのビット情報として検出できるという利点はあるが、次のような欠点を有している。すなわち、

1）コード板の製造コストが高い。

2）コード板とブラシの接触によってビット情報を得ているために、コード板表面，ブラシ面の酸化による導通不良が経時的に発生する。

3）接触圧不足や表面の摩耗等による導通不良が経時的に発生する。

このような欠点のうち、特に上記2），3）のように経時的に不良が発生するということは、ユーザーの手に渡った後に不良が発生するということになり、製品の品質上、非常に重大な問題となる。

【0004】したがって、上記2），3）の欠点を根本的に解決するには、上述したような接触式のズームエンコーダをフォトリフレクタ等を使用した光学式またはMR素子等を使用した磁気式のような非接触型の絶対値エンコーダに変換することが考えられる。しかしながら、この手段は逆にエンコーダのスペースおよびコスト上のデメリットが大きい。このデメリットは、ズームエンコーダの分解能を大きくすればする程、拡大するものであり、実用上可能と考えられるのは、せいぜい2～3ビットが限界である。

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【0005】そこで、実開平2－5130号公報に開示されているように、従来の接触式のズームエンコーダを用い、ズーミングを行うカムリングの回転に応答してパルスを発生する、光学式のパルス発生器を設け、この発生器からのパルス出力をズーム用カムリングの回転方向に応じてカウントアップもしくはカウントダウンすることにより、カムリングの回転位置を求める手段が提案されている。この手段によれば、1個のフォトインタラプタのみで高分解能のズームエンコーダを得ることができる。

【0006】

【発明が解決しようとする課題】ところが、上記実開平2－5130号公報に開示されたズームエンコーダを用いる回転位置検出装置は、いわゆる相対値エンコーダであって、従来のようなデジタルコードによる絶対値エンコーダでないために、原理的に次のような問題点がある。

（1）パルス発生器のチャッタリング等で発生する誤パルスによりミスカウントが発生した場合、ズーム状態を変えても間違ったままになる。特に、非接触型のパルス発生器ではズームモータの起動時に、よく誤パルスが発生するため、ズーム環を何回か往復移動させているうちに、ミスカウントが累積され、結果として露出およびビット情報に重大な悪影響を及ぼすことになる。

（2）カメラなどの場合には、パルス発生器の出力を始終モニタしているわけではないので、例えばユーザがレンズ鏡筒を押し込んだり、引っ張ったりすると、ズーム値が変化したにも係わらず、それを検知することができず、ズーム値が実際の状態と異なった状態で撮影が行われることになり、結果として露出およびビット情報に重大な悪影響を及ぼすことになる。

【0007】本発明の目的は、上記従来の絶対値エンコーダを非接触化することによる構成の大型化、並びにコストアップを招くことなく、比較的簡単な構成で、かつ相対値エンコーダのもつ原理的な欠点である、前記（1）（2）の問題点の発生確率を実用上、殆ど無くすことのできる非接触型のズームエンコーダを提供するにある。

【0008】

【課題を解決するための手段】本発明によるエンコーダは、図1の概念図に示すように、撮影光学系の光軸の周

りに回動することにより撮影光学系の焦点距離を変化させるカムリングの、回動量および回動方向を検出するズームエンコーダにおいて、◎撮影光学系の焦点距離を変化させる駆動手段1である上記カムリングの回動に応じてパルス信号を発生する非接触型のパルス発生手段2と、上記カムリングの回動方向に応じて上記パルス信号を加算もしくは減算するカウント手段3と、少なくとも焦点距離の広角端付近と望遠端付近において、所定の位置信号を検出する位置検出手段4と、この位置検出手段4の出力の変化に応じて上記カウント手段3のカウント値を所定の値に変更するカウント値変更手段5と、上記カウント手段3からの出力によりズーム情報を得るズーム情報検出手段6とを具備したことを特徴とする。

【0009】

【作用】ズーム移動範囲の中間位置に達したら、それまでのパルスカウント数に関係なく、カウント手段のカウント値は、正確な焦点距離に対応したカウント値に更新される。

【0010】

【実施例】以下、図示の実施例によって本発明を説明する。

【0011】図2は、本発明の第1実施例を示したものであって、このズームエンコーダ10は、カメラのズームレンズ鏡筒に適用されている。

【0012】回転環20に設けられたズームエンコーダ10は図3に示すように沈胴部A，撮影範囲部B，テレ端位置を越える領域Cの3つから成っていて、このうちA部とC部は反射率の高い銀色もしくは白色、また、B部は反射率の低い黒色となっている。さらに、上記回転環20は、図2の図中、符号アまたはイで示す方向に回動してズームレンズを駆動するようになっている。そして、このズームエンコーダ10の回動により、カメラ本体内の所定の位置に固定されたズームフォトリフレクタ11（ZPR）の出力信号が変化するようになっている。すなわち、図3に示すαの位置に上記フォトリフレクタ11が対面しているときは沈胴状態であり、βの位置に該フォトリフレクタ11が対面しているときはワイド状態、γの位置に対面しているときはテレ状態である。

【0013】ズーム駆動ユニット30は、ズームモータ31と、減速ギアー列32と、上記ズームモータ31の軸延長上に設けられ、該ズームモータ31と連動して回動するスリット33と、このスリット33の近傍に配置され、該スリット33の回動に応じて出力信号を生成するズームフォトインタラプタ34（ZPI）と、上記減速ギアー列32の最終ギアーに噛合し、上記回転環20の外周に設けられた駆動ギアー21と噛合して上記ズームモータ31の回動力を回転環20に伝達する出力ギアー35とで構成されている。

【0014】なお、上記フォトリフレクタ11およびフォトインタラプタ34の出力端は後述するCPU101（図4参照）に接続されていて、該フォトリフレクタ11およびフォトインタラプタ34の出力信号に基づいてCPU101が現在の焦点距離を検出するようになっている。

【0015】図4は本第1実施例が適用されるズームカメラのブロック系統図である。

【0016】図において、CPU101は上記ズームカメラ全体の動作を制御するマイクロコンピュータであって、該ズームカメラ動作のシーケンス制御、オートフォーカス／オートイクスポージャー（以下、AF／AEという）演算、A／D変換、LCD／LED制御およびスイッチ入力制御を司どる。

【0017】LCDパネル102はフィルムの駒数、バッテリチェック結果等をそれぞれ表示する液晶表示板である。

【0018】スイッチ操作部103は、レリーズ釦を半押ししたときに作動し、AF、AEをロックする1段目スイッチ1Rと、レリーズ釦を全押ししたときに作動する、シャッターレリーズ用の2段目スイッチ2Rと、ズームアップ用のスイッチZ－UPと、ズームダウン用スイッチZ－DOWNと、オンされたときに、上記CPU101は、上記LCDパネル102に表示を行ってズームカメラ全体を撮影可能状態にするパワーオンスイッチPOWERと、撮影中の巻戻しを行う強制巻戻し用のスイッチRWと、裏蓋を閉めたことを検知して空送りを行う裏蓋開閉スイッチBKとで構成されている。

【0019】また、図中、符号105はAF測距用のIC（AFIC）、符号122は発光ダイオード（IRED）、符号123は位置センサー（PSD）、符号124は被写体を示す。上記AFIC105は、上記CPU101からの制御信号に基づき被写体124に赤外光を投光し、その反射光をPSD123で検出し測距を行うようになっている。そして、得られた測距データは、シリアルデータバスを通じてCPU101に転送されるようになっている。

【0020】EEPROM106は、電気的に消去可能なROMであり、フィルム駆数、電出補正値ストロボ充電電圧情報、バッテリチェック情報等の各種調整値を記憶している。

【0021】ストロボユニット108は、上記CPU101からチャージ信号が与えられると充電を開始し、充電電圧は該CPU101へ送られ、A／D変換された後、EEPROM106の充電電圧情報と比較され、充電完了か否かがチェックされるようになっている。

【0022】LED表示部109は、ストロボ発光警告、AFロック等を撮影者に知らせる表示部である。

【0023】IF－IC111はインターフェース用ICでLEDドライブ回路、SPD110によって測光を行なう回路、モータドライブ回路、基準電圧回路等によ

り構成されている。

【００２４】符号１１２，１１３は、ともにモータ駆動用ＩＣであり、上記ＣＰＵ１０１から送出されるモータ駆動信号が上記ＩＦ－ＩＣ１１１内で１度デコードされた後、この駆動用ＩＣ１１２，１１３に供給されるようになっている。そして、ＣＰＵ１０１の信号により上記ズームモータ３１，ＡＦモータ１１５，巻上，巻戻しモータ１１６の何れかのモータが選択されて駆動されるようになっている。

【００２５】上記ＡＦモータ１１５の近傍には、該モータ１１５の回動に連動して出力信号を生成するフォトインタラプタ１２６が設けられていて、上記ＣＰＵ１０１は、該フォトインタラプタ１２６の出力に基づいて該ＡＦモータ１１５の回動制御を行うようになっている。

【００２６】上記巻上げ、巻戻しモータ１１６の近傍にも同様に、該モータ１１６の回動に連動して出力信号を生成するフォトインタラプタ１２７が設けられていて、上記ＣＰＵ１０１は、該フォトインタラプタ１２７の出力に基づいて該モータ１１６の回動制御を行うようになっている。

【００２７】上記ズームモータ３１は、上述したようにフォトインタラプタ３４およびフォトリフレクタ１１の出力信号に基づいてＣＰＵ１０１により制御されるようになっている。

【００２８】自動調整材１２０は、ＡＦ，ＡＥ、バッテリチェック、ストロボ調整等を工場で行なう際のチェッカとして使用される。この各データはシリアルデータバスを通じてＣＰＵ１０１に送られ、調整値を上記ＥＥＰＲＯＭ１０６に記憶するようになっている。

【００２９】フィルムのＤＸコード１５０は、ＣＰＵ１０１に直接読み込まれ、露出値を決めるための演算値として使われるようになっている。

【００３０】符号１２１はセクタ開閉用のプランジャであり、符号１２５は電池電圧の検出部で電池投入時や、電圧復帰時にＣＰＵ１０１にリセットをかける検出部である。

【００３１】次に、本第１実施例が適用されるズームカメラの作用について、図５～図８に示すフローチャートを参照して説明する。

【００３２】図５は、該ズームカメラに電源を投入したときのパワーオンリセットのサブルーチンのフローチャートである。

【００３３】図において、電池を挿入し、またはパワースイッチＰＯＷＥＲを切り換えると、ＣＰＵ１０１にパワーオンリセットがかかりカメラの動作が開始される。このパワーオンリセットのサブルーチンが呼び出されると、先ずステップＳ１０１で各ポートおよびＣＰＵ１０１内のＲＡＭの初期設定が行われた後、ステップＳ１０２で、自動調整機１２０がＣＰＵ１０１に接続されたか否かのチェック判定を行う。このチェックの結果、自動

調整機１２０がＣＰＵ１０１に接続されていればステップＳ１０３に進んで、外部装置との通信を行う。また、上記自動調整機１２０がＣＰＵ１０１に接続されていなければ、直ちにステップＳ１０４に進んでバッテリーチェックを行う。ここで、バッテリ電圧が不充分の場合は、ＬＣＤパネル１０２に電池なしを表示すると共に全てのカメラ動作を禁止する。

【００３４】この後、ステップＳ１０５において、ＥＥＰＲＯＭ１０６から所定のデータを読み込んだ後、ステップＳ１０６ではパワースイッチＰＯＷＥＲをチェックする。ここで、パワースイッチＰＯＷＥＲがオフならばステップＳ１２０に進みＬＣＤパネル１０２の表示を消去し、裏ブタの開閉や強制巻戻しを行うスイッチＢＫおよびＲＷの割り込み許可した後、ストップモード状態にする。上記ステップＳ１０６でパワースイッチＰＯＷＥＲがオンならばステップＳ１１３でズームレンズを沈胴位置から撮影可能なワイド端位置へ移動させる。そして、ステップＳ１１４に進んでＬＣＤパネル１０２に所定の情報を表示させた後、ステップＳ１１５でストロボチャージを行い撮影可能状態とする。

【００３５】ステップＳ１１６では、ＬＣＤパネル１０２への表示時間を、たとえば、９０秒にセットする。そしてユーザが何等かのステップを操作すれば再度９０秒のタイマがセットされることになる。ステップＳ１１７に進んで、９０秒経過したか否かを判断し、９０秒経過していればステップＳ１１９へ、経過していなければステップＳ１１８に進んで、裏ブタの開閉スイッチＢＫ，巻戻しスイッチＲＷおよび他の操作スイッチ（以下、ＫＥＹという）の割り込みの許可をした上でホルトモード状態にする。上記ストップモード状態，ホルトモード状態で割り込みの許可されたスイッチが押されたときは、図６に示す、スタンバイ解除のサブルーチンが実行される。

【００３６】次に、このスタンバイ解除のサブルーチンを図６のフローチャートを参照して説明する。

【００３７】まず、ステップＳ１２１で裏ブタスイッチＢＫによる割込みがチェックされる。ここで、この裏ブタスイッチＢＫによる割込みがあれば、ステップＳ１２２に進んで裏ブタが閉じているか否かが判断される。このステップＳ１２２で、裏ブタが閉じていなければステップＳ１２４へ進んで裏ブタを開ける処理が行われた後、図５の“１”へ戻る。また、裏ブタが閉じているならばステップＳ１２３で空送り処理をした後、上記“１”へ戻る。

【００３８】ステップＳ１２５では巻戻しスイッチＲＷによる割込みがチェックされる。ここで、この巻戻しスイッチＲＷによる割込みがあればステップＳ１２７に進んでフィルムの巻戻しを行う。

【００３９】ステップＳ１２８ではタイマ割込みがチェックされる。ここでタイマ割込みがあればステップＳ１

３４に進んで表示タイマカウント処理を行った後、ステップＳ１３５で測光を行い図5の“2”へ戻る。上記ステップＳ１２８でタイマ割込みでない場合は、ステップＳ１２９に進んでフィルム巻戻し終了か空送り失敗かのチェックを行う。ここで、フィルム巻戻し終了か空送り失敗ならカメラが動作しないように図5の“1”へ戻る。また、フィルム巻戻し終了か空送り失敗でなければ、ステップＳ１３０へ進む。このステップＳ１３０ではパワースイッチＰＯＷＥＲの状態をチェックし、オフなら上記“1”へ進み、オンならステップＳ１３１に進んでそのままメインフローを続行する。

【００４０】上記ステップＳ１３１では上記ＫＥＹによる割込みの判定が行なわれる。後記各モードスイッチが押されて割り込みが発生すれば、図7の“3”に飛び、割込みがなければステップＳ１３２に進む。

【００４１】上記ステップＳ１３２ではＬＣＤパネル１０２に何らかの情報が表示中か否かをチェックし、表示中でなければステップＳ１３３に進んで各操作スイッチＢＫ，ＲＷ等のＫＥＹの割り込みを許可してストップモード状態となる。上記ステップＳ１３２でＬＣＤパネル１０２が表示中なら図5の“2”へ戻る。

【００４２】なお、ステップＳ１１７，ステップＳ１３１，ステップＳ１３３におけるＫＥＹとは、図4に示すスイッチ操作部１０３中のスイッチを意味する。

【００４３】次に、上記ＫＥＹ割り込みの処理のサブルーチンを図7を参照して説明する。

【００４４】上記ステップＳＳ１３１（図6参照）でＫＥＹ割込みがあれば図7のステップＳ１４１に進んでＬＣＤパネル１０２（図4参照）をオンする。この後、ステップＳ１４３に進んで1段目のレリーズスイッチ１Ｒが押されているか否かをチェックする。この1段目のレリーズスイッチ１Ｒが押されていれば、ステップＳ１４４においてレリーズ処理を行った後、図5の“1”へ戻る。上記ステップＳ１４３で1段目のレリーズスイッチ１Ｒがオフならステップ Ｓ１４６へ進み、ズームアップまたはズームダウンの指示がなされていればステップＳ１５８へ進む。このステップＳ１５８ではＬＣＤパネル１０２が表示中か否かをチェックし、表示中であれば、図5の“2”へ、また、表示中でなければ図6の“4”へ戻る。

【００４５】上記ステップＳ１４６において、ズームアップまたはズームダウンの指示があったときはステップＳ１４７へ進んでズーム処理がなされる。

【００４６】次に、上記図5のステップＳ１１３における、ズームレンズを沈胴位置から撮影可能なワイド端位置へ移動させるステップを、図8のフローチャートおよび図１０を参照してさらに詳しく説明する。

【００４７】ステップＳ３０１において、ズームモータ３１（図4参照）を正転させた後、ステップＳ３０２で上記フォトリフレクタ１１（ＺＰＲ、図4参照）の出力信号をＡ／Ｄ変換する。この後、ステップＳ３０３において、該Ａ／Ｄ変換値より所定のしきい値＃ＴＨ１を減算する。

【００４８】この後、ステップＳ３０４において、上記ステップＳ３０３における比較値を判断（ＣＹ）し、ボローがでなければ上記Ａ／Ｄ値は上記しきい値＃ＴＨ１より高い、すなわちフォトリフレクタ１１の出力信号は“Ｈ”レベルと判断してステップＳ３０２へもどる。上記Ａ／Ｄ値がしきい値＃ＴＨ１より低くなればフォトリフレクタ１１の出力信号が“Ｌ”レベルになったと判断しステップＳ３０５へ進む。

【００４９】このステップＳ３０５で、ズームレンズの現在値を示すＣＰＵ１０１内部のＲＡＭ上のＺＭＰＬＳをリセットした後、ステップＳ３０６で、上記フォトインタラプタ３４（ＺＰＩ、図4参照）の出力値をチェックして（ＺＰＩＨＲＤ）、立上りエッヂがあったとき、上記ＺＭＰＬＳを＋1する。

【００５０】この後、ステップＳ３０７で、ズームレンズの現在値ＺＭＰＬＳからワイド端位置を示す値＃ＷＩＤＥを減算して、ステップＳ３０８において比較値を判断（ＣＹ）し、ボローがあればまだワイド端位置でないので上記ステップＳ３０６へもどり、ボローがなければワイド端位置なのでステップＳ３０９へ進む。

【００５１】このステップＳ３０９では、ズームモータ３１にブレーキをかけ（ＺＭＯＴＢＫ）、ステップＳ３１０において一定時間待機した後（ＴＩ）、ステップＳ３１１においてズームモータ３１を停止させてメインルーチンにもどる（ステップＳ３１２）。

【００５２】次に、上記ステップＳ１４７におけるズーム処理について図9のフローチャートを参照して説明する。

【００５３】ステップＳＳ５０１では、ズームモータ駆動に必要なＣＰＵ１０１（図4参照）のポート初期化、およびＩＦＩＣ１１１の起動を行う。この後、ステップＳ５０２において、ズームモータ３１（図4参照）の駆動方向を示すフラグＺＵＤＦを見て該フラグＺＵＤＦ＝1ならばズームモータ３１を正転させるようステップＳ５０４へ進む。上記ステップＳ５０２においてフラグＺＵＤＦ＝0のときは、該ズームモータ３１を逆転させるようにステップＳＳ５０３へ進む。

【００５４】この後、ステップＳ５１１において、ズームスイッチＺＳＷ、すなわち、前記ズームアップ用スイッチＺ－ＵＰとズームダウン用スイッチＺ－ＤＯＷＮとの何れかがオンされたか否かをチェック（ＣＫ）し、該ズームスイッチＺＳＷが何れもオフならばステップＳ５１６へ進む。

【００５５】上記ステップＳ５１１でズームアップ用スイッチＺ－ＵＰとズームダウン用スイッチＺ－ＤＯＷＮとの何れかがオンされているときは、ステップＳ５１２へ進む。

【００５６】このステップＳ５１２では、ズームレンズの現在値を示す上記ＺＭＰＬＳによりズーム位置がワイド端位置あるいはテレ端位置になったかを判定し、ワイド端位置，テレ端位置のどちらかになった所で、上記ズームモータ３１を停止すべステップＳ５１６へ進む。また、上記ステップＳ５１２で、ズームレンズ位置がワイド端位置あるいはテレ端位置に達していないときは、次にステップＳ５１３に進む。

【００５７】このステップＳ５１３では、通常のズーム動作中は、上記フォトリフレクタ１１（ＺＰＲ）の出力信号は“Ｌ”レベルであるが、ズーム駆動中に“Ｈ”レベルになったときは、誤カウントと判断して上記ＺＭＰＬＳをリセットする。また、ズームダウン中に該フォトリフレクタ１１（ＺＰＲ）の出力信号が“Ｈ”レベルになったときは、ズームモータ３１を正転させ、上述したズーム処理を行えば、リセットできる。また、ズームアップのときは該フォトリフレクタ１１（ＺＰＲが）の出力信号がしきい値＃ＴＨ２（図１１参照）を越えて“Ｈ”レベルになった所でテレ端位置を示す値＃ＴＥＬＥ分のパルスをカウントし、上記ＺＭＰＬＳをテレ端位置に相当するパルス数にリセットする。

【００５８】この後、ステップＳ５１４でフォトインタラプタ３４（ＺＰＩ）の検出用タイマをスタートさせ、ステップＳ５１５で、該フォトインタラプタ３４のパルス立上りをチェックして上記ＺＭＰＬＳをカウントアップもしくはカウントダウンする。ここで、一定時間内に該フォトインタラプタ３４の立上りがなければズームモータ３１あるいはズームエンコーダ１０の故障と判断して、ステップＳ５２１の異常処理（ＤＡＭＡＧ）へ行く。

【００５９】上記ステップＳ５１６は、上記フラグＺＵＤＦを判断してＺＵＤＦ＝０ならばステップＳ５１７へ進む。

【００６０】このステップＳ５１７は、メカを一方向に駆動することでギアのバックラッシ取りを行う。駆動量としてはズームモータ３１を正転させてフォトインタラプタ３４の立上り１パルスが生じたときに該モータ３１を停止する。

【００６１】この後、ステップＳ５１８で上記ズームモータ３１に一定時間ブレーキをかけ（ＺＭＭＯＴＢ）、ステップＳ５１９で該ズームモータ３１を停止させた後、メインルーチンにもどる（ステップＳ５２０）。

【００６２】図１２は、本発明の第２実施例を示したものであって、このズームエンコーダ２１０は、カメラのズームレンズ鏡筒に適用されている。ズームレンズ駆動用のカム筒からなるカムリング２１２には、バリエータ等の前群レンズとコンペンセータ等の後群レンズとからなる内蔵ズームレンズ群２１１を光軸方向に移動するための傾斜カム溝孔２１３，２１４が穿設されている。このカム溝孔２１３，２１４には、図示されない前群レンズ保持枠と後群レンズ保持枠とにそれぞれ一体に植立されたガイドピン２１６，２１７が嵌挿されている。

【００６３】上記カムリング２１２のカメラ本体２１５がわの基部寄りの外周面には、周方向にリング駆動用のセクタギアー２１９が一体に設けられており、このセクタギアー２１９には駆動用ギアー２１８が噛み合っている。この駆動用ギアー２１８にはモータ２２０の出力ギアー２２１の回転力が減速歯車列２２２を介して伝達されるようになっている。したがって、上記モータ２２０が正転または逆転駆動されると、その回転力は減速歯車列２２２を介して駆動用ギアー２１８に伝達され、これによってカムリング２１２が光軸の周りに正方向または逆方向に回転し、上記カム溝孔２１３，２１４とガイドピン２１６，２１７とにより、前群レンズと後群レンズとの間隔を変えるように前群レンズ保持枠と後群レンズ保持枠とが光軸方向に移動し、これによってズーム撮影レンズのズーミングがなされる。

【００６４】また、上記駆動用ギアー２１８にはパルス発生器２２３のパルス発生用の回転板２２４を回転駆動するためのギアー２２５が噛み合っている。上記パルス発生器２２３は、円周方向に等間隔であつて放射方向に多数延び出すように形成された透光部と遮光部とが交互に形成された上記回転板２２４と、この回転板２２４の一部を挟んで対向して配設された光照射部と受光部とからなるフォトインタラプタ２２６とで構成されている。このパルス発生器２２３は上記カムリング２１２を回転駆動する駆動用ギアー２１８の回転に連動して回転板２２４が回転し、フォトインタラプタ２２６によってカムリング２１２の回動に応答するパルス信号Ｐ，Ｉを出力する。

【００６５】そして、上記カムリング２１２の外周面の一部には、絶対値エンコーダ用の読取用パターン１３０が形成されている。この読取用パターン１３０は、高反射率部の凸部と非反射部の凹部との凹凸形状のパターンで形成されており、本第２実施例ではカムリングそのものの外周面を凸部とし、凹部をカムリングに穿設した穴部で形成している。すなわち、この読取用パターン１３０は、図１３に、その平面形状を拡大して示すように、全体の形状が周方向に横長の長方形からなり、その左方部にＬ字状に穿設された穴部１３０ａと右方上半部に角穴状に穿設された穴部１３０ｂからなる凹部と、中央部に設けられていて、上記穴部１３０ａに対向して逆Ｌ字状に形成された高反射率部１３１ａと同高反射率部１３１ａに連設して上記穴部１３０ｂに対向する位置に形成された高反射率部１３１ｂとからなる凸部とで形成されている。

【００６６】このように形成された読取用パターン１３０に対向する位置、つまりカムリング２１２の外側であって、上記読取用パターン１３０に対向する位置には、図１２に示すように、フォトリフレクタ１３２ａ，１３

2bが光軸方向に並んで、図示されない不動部材に固定されている。そして、このフォトリフレクタ（P．R）132a，132bが絶対値エンコーダの出力信号PR1，PR2を発生する。

【0067】すなわち、このフォトリフレクタ132a，132bは図13に示す如く、その出力信号PR1，PR2がカムリング212の回動とともに、（1．1）→（0．1）→（0．0）→（1．0）と変化する。

ここで、（1．1）と（0．1）の変化点を沈胴位置◎
（0．1）と（0．0）の間をワイド端（広角端）位置◎
（0．1）と（0．0）の変化点をスタンダード位置（S位置）◎
（0．0）と（1．0）の変化点をテレ端（望遠）位置◎
としてそれぞれ設定してある。なお、本実施例ではズーム倍率が35mm～80mmのズームレンズが使用されているものとし、ワイド端（W端位置）で35mm，テレ端（T端位置）で80mmの焦点距離となる。

【0068】図14は、上記ズームエンコーダが適用されたカメラの電気回路の要部の構成を示したものである。カメラのズーミング動作および撮影動作をシーケンス制御するCPU133には、パワースイッチPWSW，ズームアップ用スイッチZUSW，ズームダウン用スイッチZDSWの各動作信号がそれぞれ入力するようになっており、CPU133は、これらの信号によってモータドライブ回路134を制御して前記駆動モータ220の回転を制御する。そして、前記カムリング212の回動によって出力されるパルス発生器223のパルス信号P．I，上記フォトリフレクタ132a，132bの出力信号PR1，PR2をそれぞれモニタするようになっている。なお、EEPROMからなる記憶素子135には、ワイド端位置を示すパルス数“10”およびS位置を示すパルス数“40”が記憶されている。

【0069】次に、このように構成された本実施例のズームエンコーダを有するズームレンズの動作を、図15～図18に示すフローチャートと共に説明する。先ず、カメラのパワースイッチPWSWがオフされると、CPU133はこれを検知し、必ずズームレンズを沈胴状態にセットし、カメラ動作を停止する。すなわち図15に示す沈胴ルーチンについて述べると、レンズ鏡筒における沈胴領域は前記図13に示したようにフォトリフレクタ132a，132bの出力PR1，PR2が、PR1＝1，PR2＝1の領域である。よって、パワースイッチPWSWがオフされると、CPU133はステップS1において、モータドライブ回路134にズームモータの逆転指令を与え、モータ220を逆転させながら入力ポートP.R.1，P.R.2が共に1となるまで逆転をさせ、これをチェック（ステップS2）する。そして、これが

共に1となった時点で、モータドライブ回路134にモータ停止指令を与え、ズームモータ220の回転を停止（ステップS3）し、リターンする。これでズームレンズは沈胴位置にセットされる。

【0070】次に、パワースイッチPWSWがオンされると、図16に示すようにパワーオンルーチンが動作し、CPU133はズーム撮影レンズを沈胴状態からワイド端W位置である焦点距離35mmの繰出し位置にセットする。すなわち、パワースイッチPWSWがオンされると、CPU133は先ず、モータドライブ回路134にズームモータの正転指令（ステップS11）を与え、ズームモータ220を正転させながら入力ポートP.R.1，P.R.2をモニタ（ステップS12）し続ける。そして撮影レンズが出力P.R.1＝1，P.R.2＝1の沈胴状態位置から出力P.R.1＝0，P.R.2＝1となる位置に移動すると、これに同期してCPU133はパルス発生器223からのパルス信号P．Iのアップカウントを開始（ステップS13）し、ステップS14で、このカウント値のチェックをする。そして、EEPROM135（図14参照）に書き込まれているワイド端位置を示すパルス数“10”に達するまで、モータの回転を続行する。予定のパルス数“10”に達したところで、ズームモータ220の回転を停止（ステップS15）させ、リターンする。これでズームレンズは沈胴状態から焦点距離35mmのワイド端W位置に設定される。

【0071】次いで、撮影者がズームアップ用スイッチZUSWをオンしてズームアップ動作を行うと、図17に示すZUルーチンが作動する。上記スイッチZUSWをオンすると、先ずテレ端位置（T端位置）にあるか否かを、CPU133はフォトリフレクタ132a，132bの出力PR1，PR2によってチェック（ステップS21）する。テレ端位置（T端位置）にあれば、ステップS28に移行してズームモータ停止ルーチンにて停止処理を行い、パルス発生器223からのパルス信号P．Iのアップカウントを停止（ステップS29）し、リターンする。

【0072】テレ端位置（T端位置）になければ、次のステップS22に移行し、パルス信号P．Iのアップカウントを開始する。そして、ステップS23でズームモータ220を正転させる。その間、アップカウントを続行しつつ、CPU133は入力ポートP.R.1，P.R.2をモニタし、出力PR1，PR2の変化（ステップS24）とズームアップ用スイッチZUSWの状態をモニタ（ステップS25）する。このスイッチZUSWがオフすれば、すなわち、撮影者が所望のズーム位置を決定すると、ステップS28に飛び、ズームモータ220を停止してパルス信号P．Iのアップカウントを停止（ステップS29）し、リターンする。そして、その間に出力PR1，PR2の変化（ステップS24）があれば、ステップS26においてS位置かT端位置かを確認し、T

端位置であればステップＳ２８に飛び、ズームモータ２２０を停止してパルス信号Ｐ．Ｉのアップカウントを停止（ステップＳ２９）し、リターンする。また、Ｓ位置であれば、ステップＳ２７においてＰ．Ｉのカウント値を“４０”にセットし、ステップＳ２４に戻る。ここでカウント値を上記の値にセットすることはカウント値を更新したことになり、以後のカウント値を正確なものにすることができる。このようにしてズームアップ動作時のエンコーダは動作する。

【００７３】次に、撮影者がズームダウン用スイッチＺＤＳＷを押してズームダウン動作を行うと、図１８に示すＺＤルーチンが動作する。上記スイッチＺＤＳＷをオンすると、ＣＰＵ１３３はそれを検出して、先ず現在のＰ．Ｉのカウント値がワイド端位置のパルス数“１０”以下であるか否かを確認（ステップＳ３１）する。その結果、“１０”以下であれば、ステップＳ３８に飛ぶ。ワイド端でなければ、ズームアップ方向の位置にレンズがあるので、レンズをズームダウン方向に移動させる。すなわち、Ｐ．Ｉのダウンカウントを開始（ステップＳ３２）させ、ズームモータ２２０を逆転（ステップＳ３３）させる。その間、ダウンカウントを続行させつつ、出力ＰＲ１，ＰＲ２の変化（ステップＳ３４）とズームダウン用スイッチＺＤＳＷの状態をモニタ（ステップＳ３７）する。そして、撮影者が所望するズーム位置にレンズが移動すると、スイッチＺＤＳＷがオフされる。このズームダウン用スイッチＺＤＳＷがオフすると、ギアーのバックラッシ取りのためにズームモータ２２０を正転（ステップＳ３８）させ、Ｐ．Ｉのアップカウント（ステップＳ３９）を行い、所定アップカウント（ステップＳ４０）、例えば2アップカウント後、ズームモータ２２０を停止（ステップＳ４１）してパルス信号Ｐ．Ｉのカウントを停止（ステップＳ４２）させ、Ｐ．Ｉのカウンタからバックラッシ分の１カウントを減算（ステップＳ４３）し、リターンする。また、ステップＳ３７において、スイッチＺＤＳＷがオンしておれば、ステップＳ３４に戻るループをとる。

【００７４】一方、ステップＳ３４において出力ＰＲ１，ＰＲ２の変化があれば、次にステップＳ３５で、Ｓ位置か否かのチェックが行われ、Ｓ位置であればステップＳ３６において、Ｐ．Ｉのカウントを Ｓ位置を示す“４０＋（バックラッシ分１）＝４１”にセットし、ステップＳ３１に戻る。このようにカウント値を上記の値にセットすることはカウント値を更新したことになり、以後のカウント値を正確なものにする。このようにしてズームダウン動作時のエンコーダは動作する。

【００７５】

【発明の効果】以上述べたように本発明によれば、構成の大型化，並びにコストアップを招くことなく、相対値エンコーダのもつ原理的な欠点であるミスカウントも、ズームのアップ／ダウン操作途上にて自動的に修正されるため、信頼性の著しく向上した相対値非接触型のズームエンコーダを提供することができる。

【図面の簡単な説明】

【図１】本発明のズームエンコーダの概念図。

【図２】本発明の第１実施例を示すズームエンコーダの斜視図。

【図３】上記第１実施例におけるフォトリフレクタの読取用パターンとフォトリフレクタ出力との関係を示す線図。

【図４】上記第１実施例のズームエンコーダの要部の電気回路のブロック構成図。

【図５】上記第１実施例が適用されるズームカメラに電源を投入したときの、パワーオンリセット時のサブルーチンを示すフローチャート。

【図６】上記第１実施例が適用されるズームカメラの、スタンバイ解除時のサブルーチンを示すフローチャート。

【図７】上記第１実施例が適用されるズームカメラにおけるスイッチ操作よる割り込み処理のサブルーチン示すフローチャート。

【図８】上記第１実施例が適用されるズームカメラにおいて、ズームレンズが沈胴位置から撮影可能なワイド端位置へ移動される際の動作を示すフローチャート。

【図９】上記第１実施例が適用されるズームカメラにおける、ズーム処理を示すフローチャート。

【図１０】上記第１実施例が適用されるズームカメラにおいて、ズームレンズが沈胴位置から撮影可能なワイド端位置へ移動される際の、ズームモータとズームフォトリフレクタおよびズームフォトインタラプタの出力信号との関係を示したタイムチャート。

【図１１】上記第１実施例が適用されるズームカメラにおいて、ズームレンズが沈胴位置から撮影可能なテレ端位置へ移動される際の、ズームモータとズームフォトリフレクタおよびズームフォトインタラプタの出力信号との関係を示したタイムチャート。

【図１２】本発明の第２実施例を示すズームエンコーダの斜視図。

【図１３】上記第２実施例におけるフォトリフレクタの読取用パターンとフォトリフレクタ出力との関係を示す線図。

【図１４】上記第２実施例のズームエンコーダの要部の電気回路のブロック構成図。

【図１５】上記第２実施例が適用されるズームカメラにおけるズームレンズの沈胴ルーチンのプログラムのフローチャート。

【図１６】上記第２実施例が適用されるズームカメラのパワースイッチをオンしたときのパワーオンルーチンのプログラムのフローチャート。

【図１７】上記第２実施例が適用されるズームカメラのズームアップスイッチをオンしたときのＺＵルーチンの

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プログラムのフローチャート。

【図１８】上記第２実施例が適用されるズームカメラのズームダウンスイッチをオンしたときのＺＤルーチンのプログラムのフローチャート。

【符号の説明】

１…ズーム駆動手段

２…非接触型パルス発生手段

３…パルスカウント手段

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４…ズーム所定位置検出手段

５…カウント値更新手段

１０…ズームエンコーダ

１１…ズームフォトリフレクタ

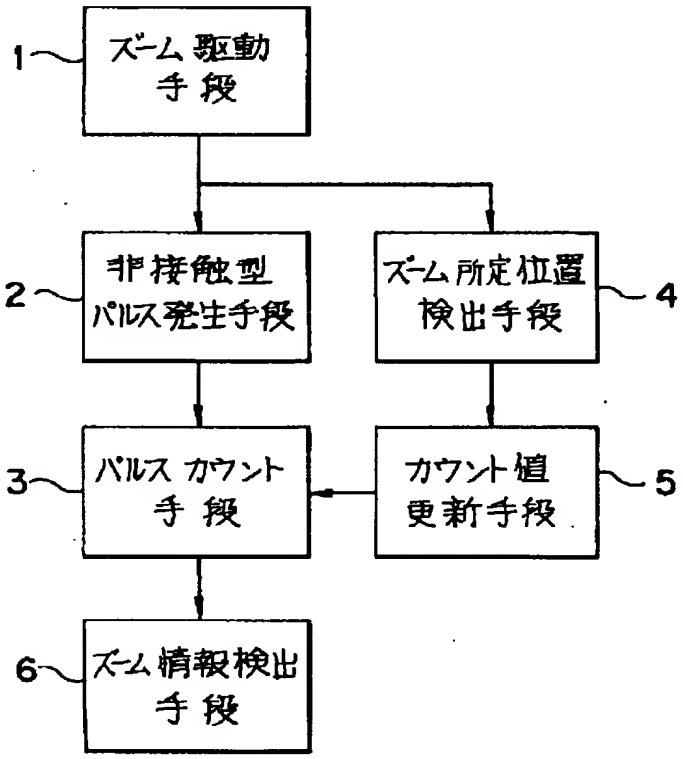
２０…回転環

３０…ズームモータ駆動ユニット

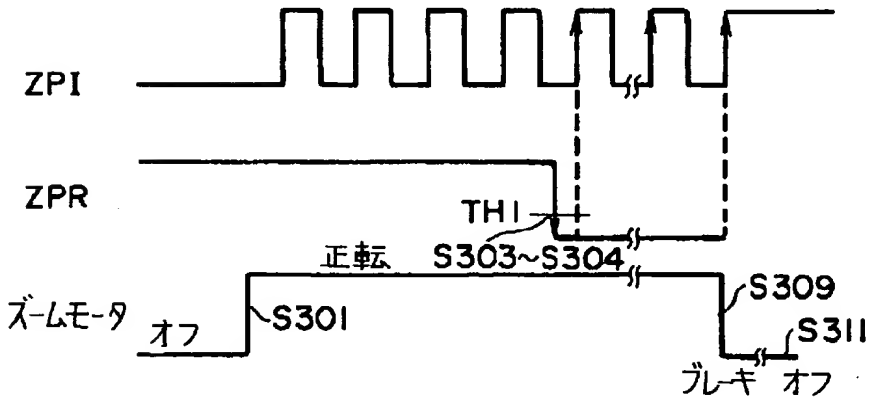
３１…ズームモータ

３４…ズームフォトインタラプタ

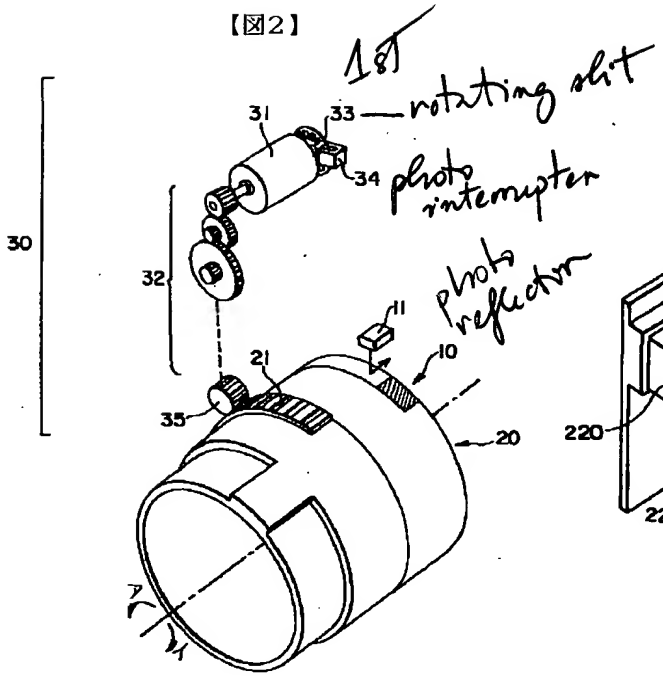
【図1】



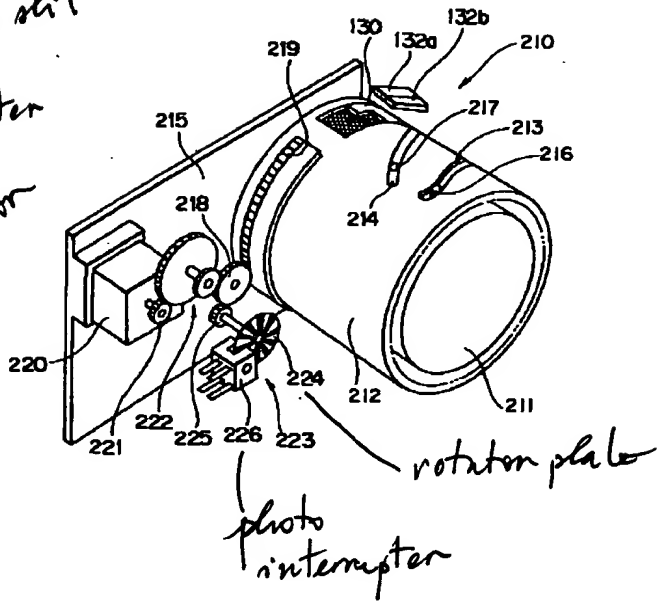
【図１０】



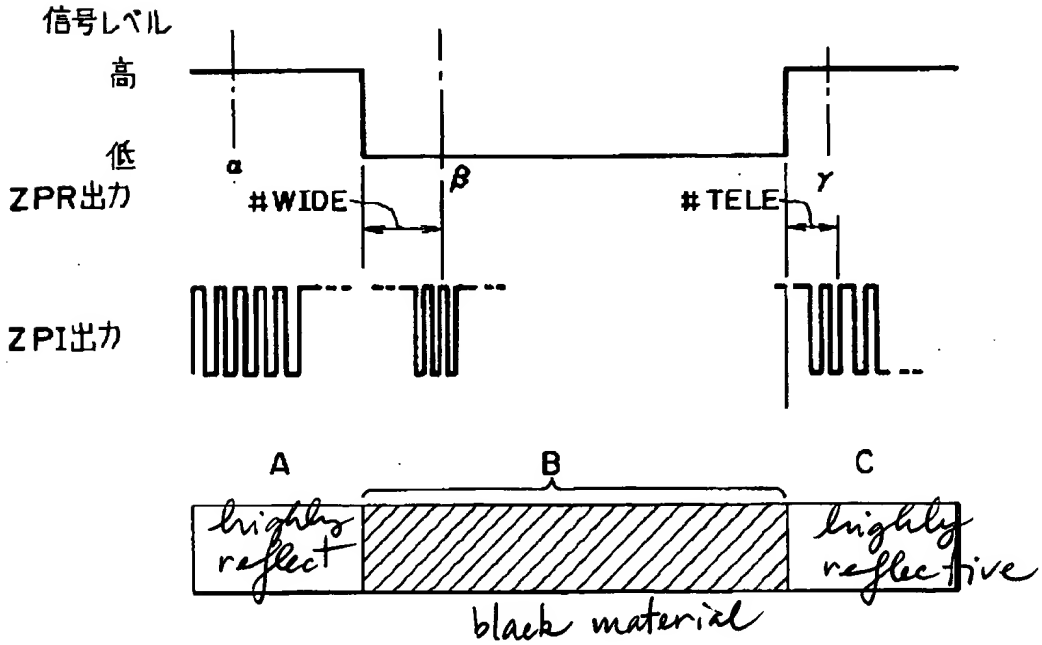
【図2】



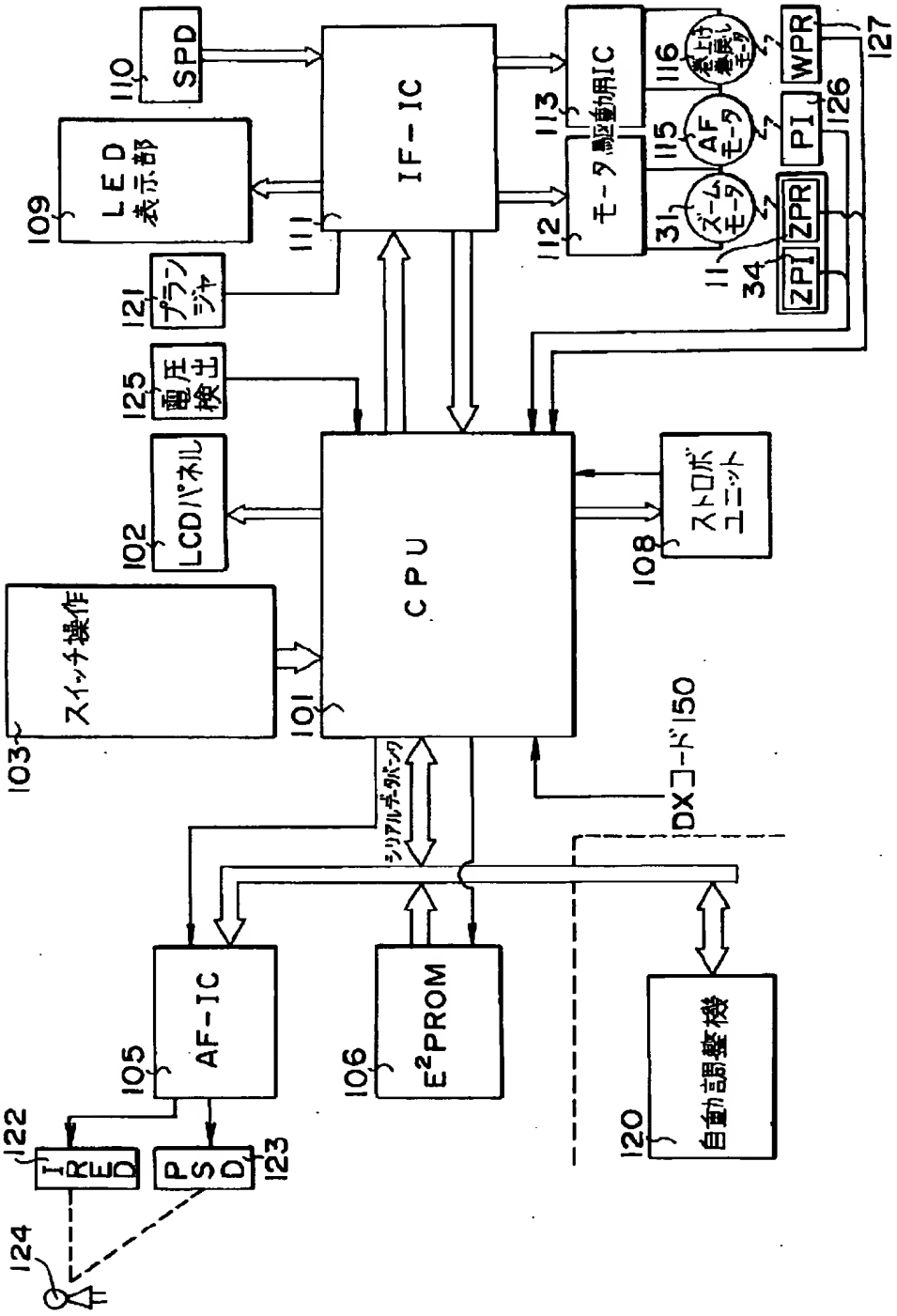
【図12】 2nd



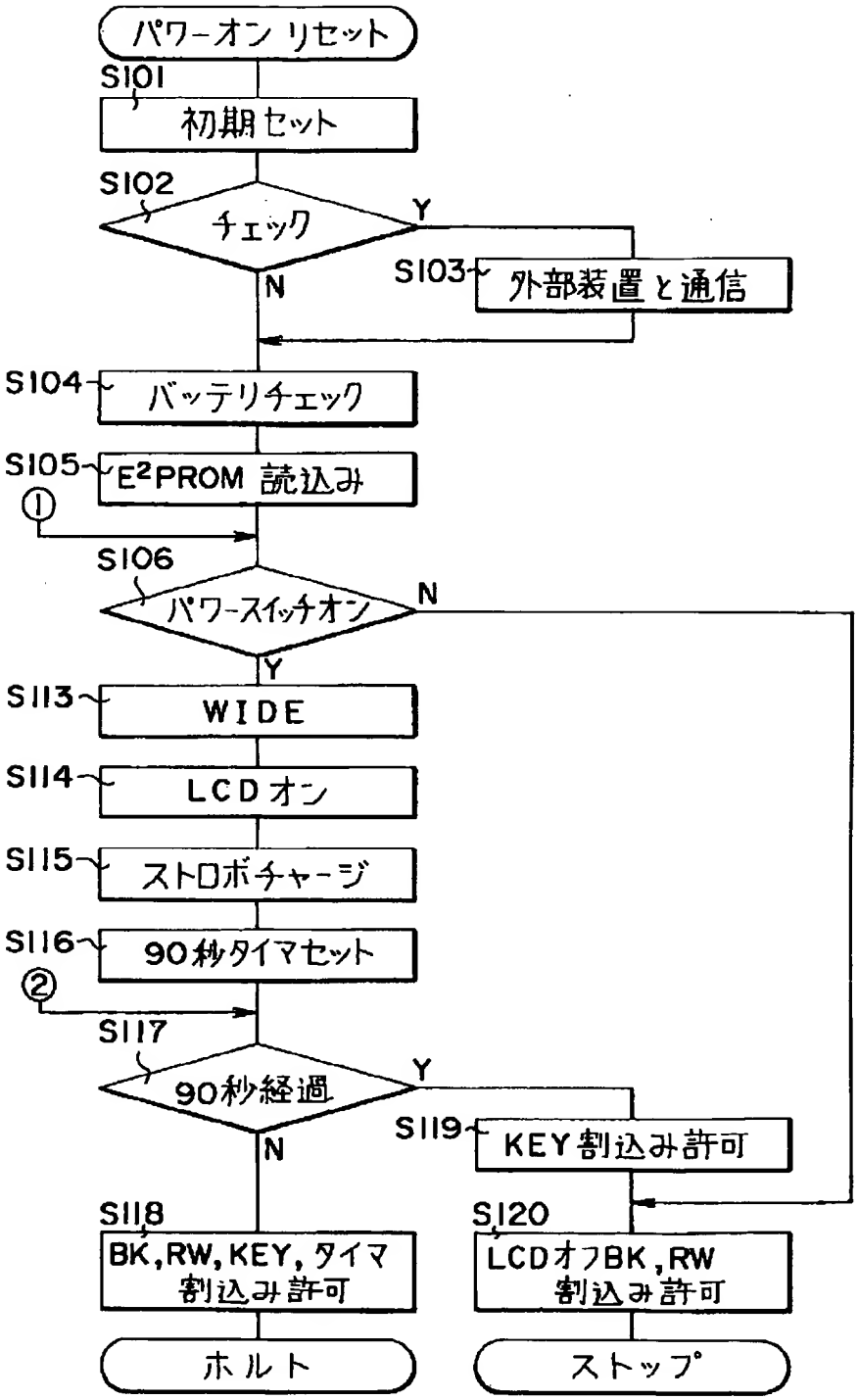
【図3】 1st



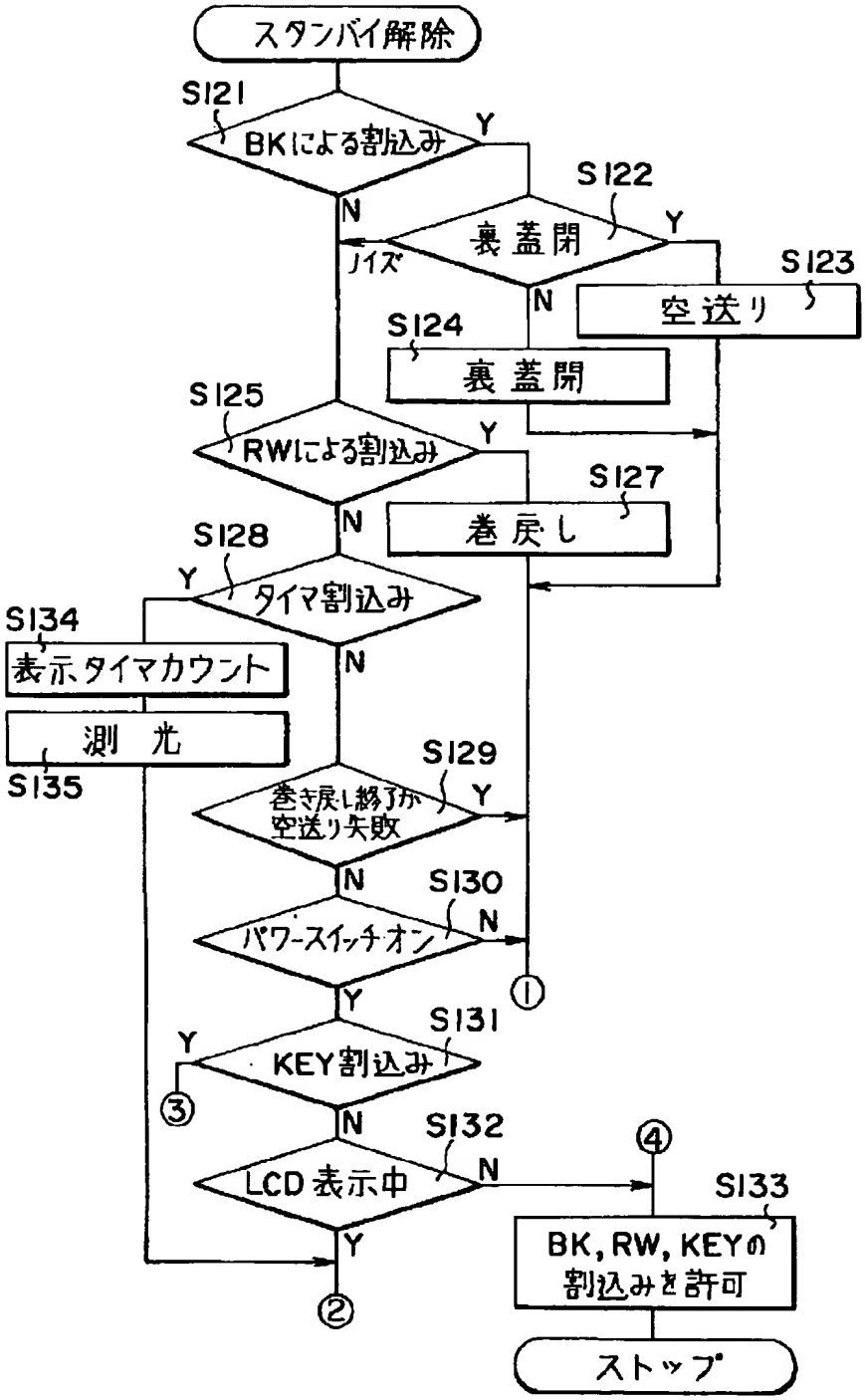
【図4】


SPD
110
LED 表示部
109
IF－IC
111
モータ駆動用IC
113
116
AF モータ
115
ズームモータ
31
112
WPR
127
PI
126
ZPR
ZPI
34
11
プランジャ
121
電圧検出
125
LCDパネル
102
CPU
ストロボ ユニット
108
スイッチ操作
103
101
DXコード
150
シリアルポート
AF－IC
105
E²PROM
106
自動調整機
120
IRED
122
PSD
123
124

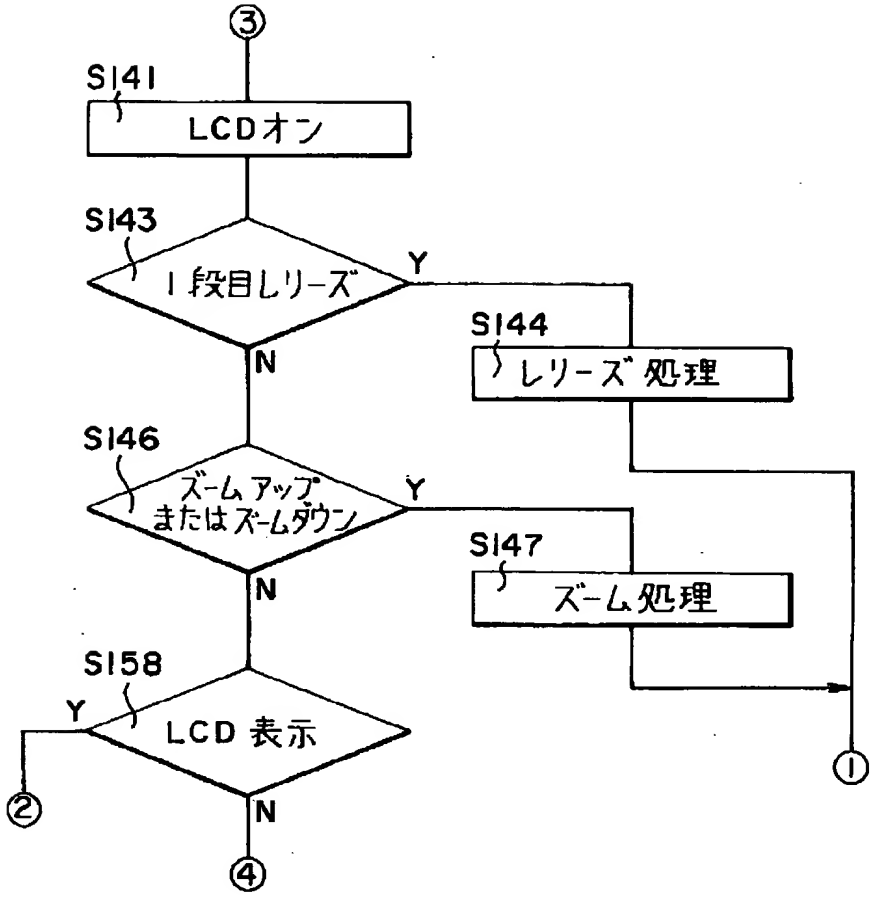
【図5】


パワーオン リセット
S101
初期セット
S102
チェック
Y
N
S103
外部装置と通信
S104
バッテリチェック
S105
E²PROM 読込み
①
S106
パワースイッチオン
N
Y
S113
WIDE
S114
LCDオン
S115
ストロボチャージ
S116
90秒タイマセット
②
S117
90秒経過
Y
N
S119
KEY割込み許可
S118
BK,RW,KEY,タイマ
割込み許可
S120
LCDオフBK,RW
割込み許可
ホルト
ストップ

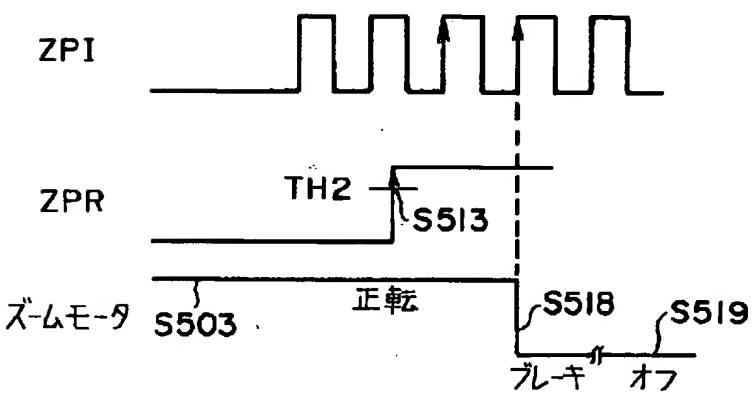
【図6】


スタンバイ解除
S121
BKによる割込み
Y
N
S122
裏蓋閉
Y
ノイズ
N
S123
空送り
S124
裏蓋開
S125
RWによる割込み
Y
N
S127
巻戻し
S128
タイマ割込み
Y
N
S134
表示タイマカウント
測光
S135
S129
巻き戻し終了か
空送り失敗
Y
N
S130
パワースイッチオン
N
Y
①
S131
KEY割込み
Y
③
N
S132
LCD表示中
N
Y
②
④
S133
BK, RW, KEYの
割込みを許可
ストップ

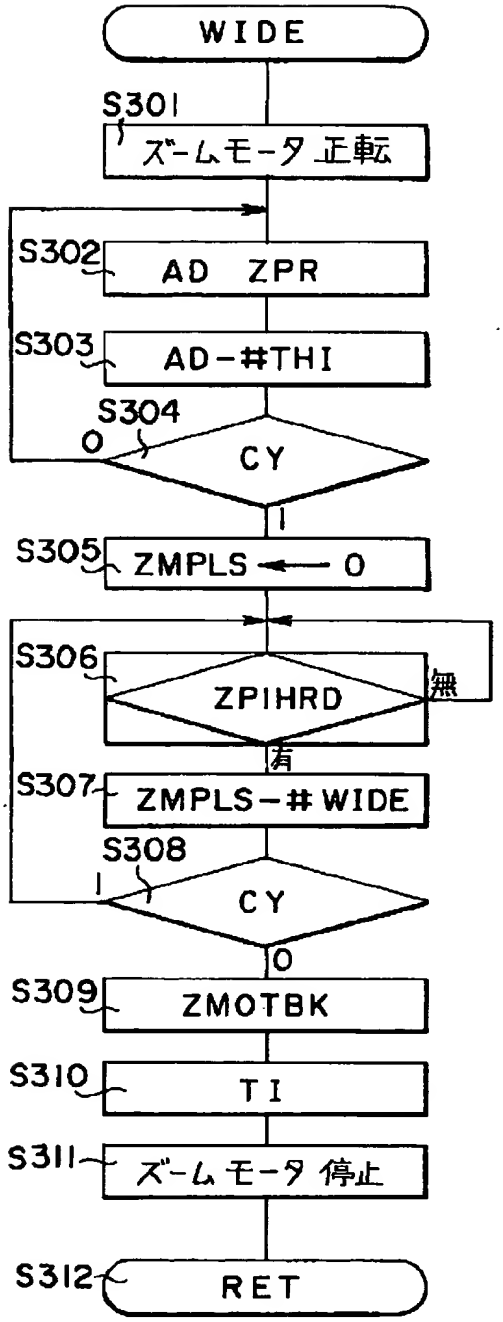
【図7】


③
S141
LCDオン
S143
1段目しリーズ
Y
N
S144
レリーズ処理
S146
ズームアップ
またはズームダウン
Y
N
S147
ズーム処理
S158
Y
LCD 表示
N
②
④
①

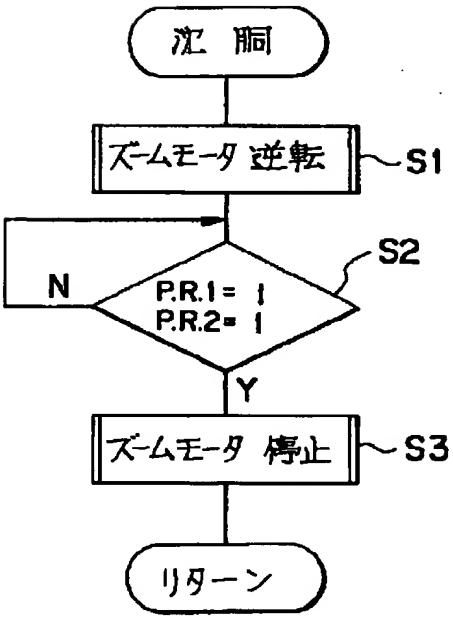
【図11】


ZPI
ZPR
TH2
S513
ズームモータ
S503
正転
S518
S519
ブレーキ
オフ

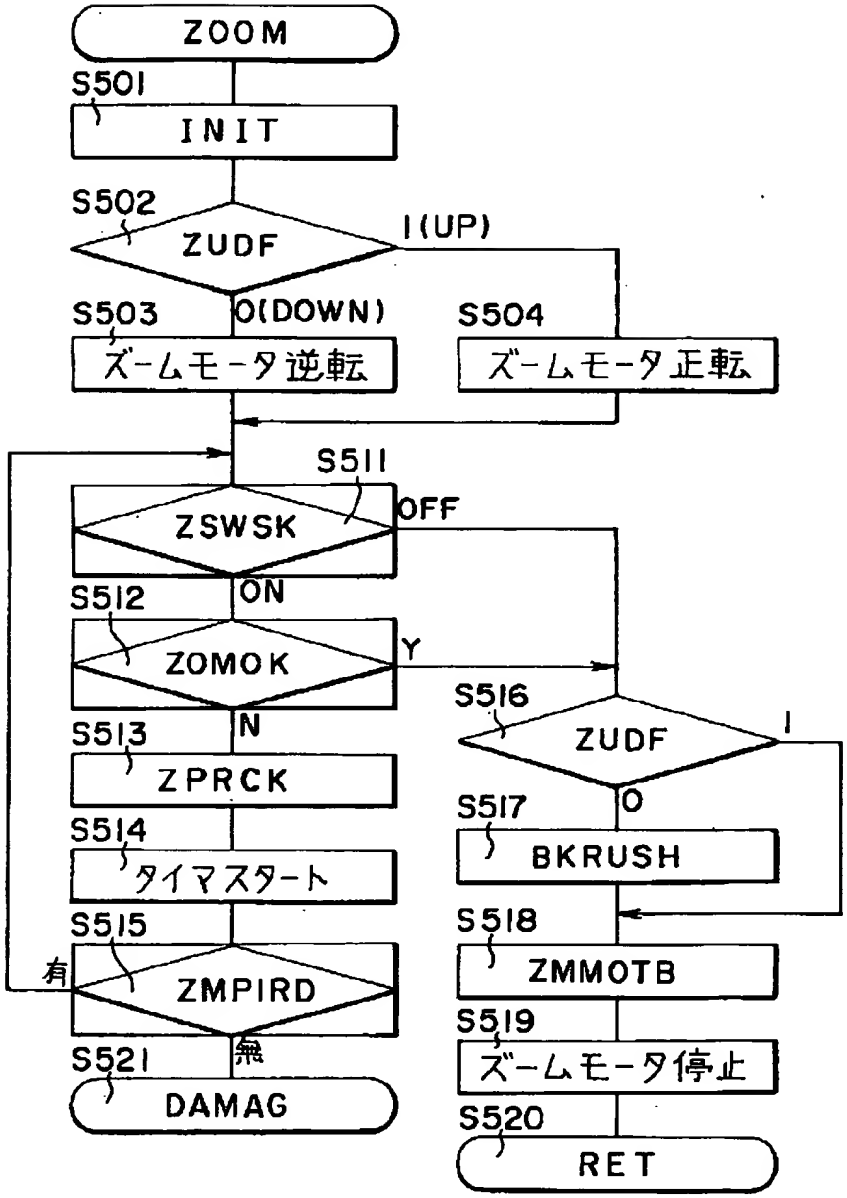
【図8】


WIDE
S301
ズームモータ 正転
S302
AD ZPR
S303
AD−#THI
S304
CY
0
1
S305
ZMPLS ← 0
S306
ZPIHRD
無
有
S307
ZMPLS−#WIDE
S308
CY
1
0
S309
ZMOTBK
S310
TI
S311
ズームモータ 停止
S312
RET

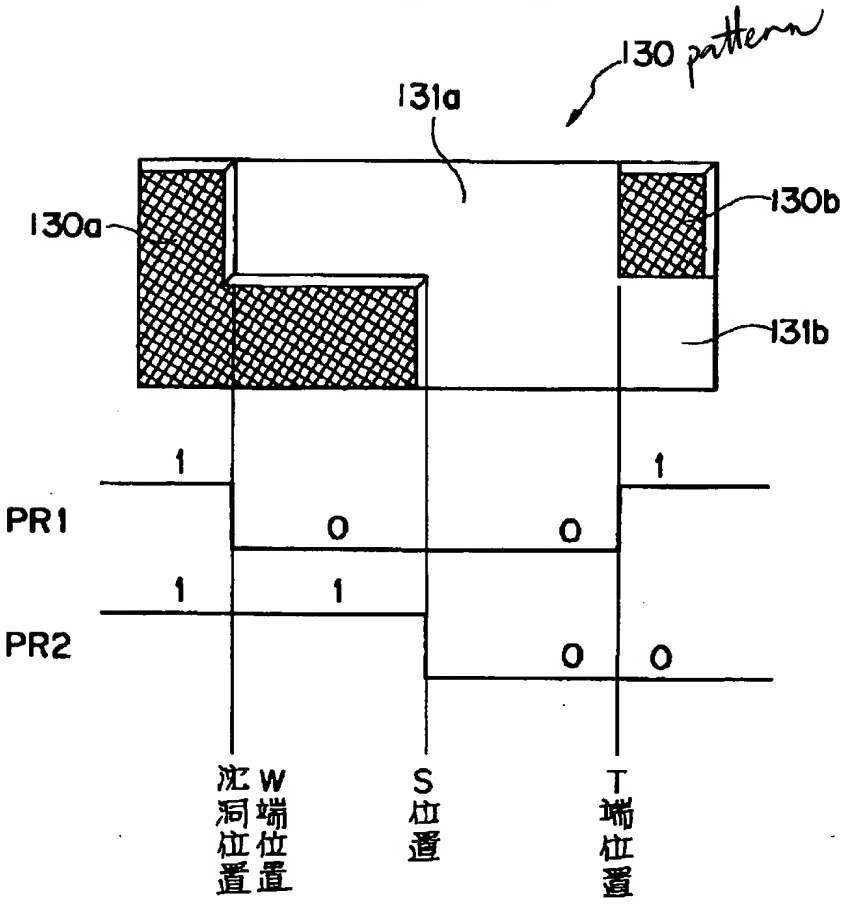
【図15】


定 胴
ズームモータ 逆転
S1
S2
N
P.R.1 = 1
P.R.2 = 1
Y
ズームモータ 停止
S3
リターン

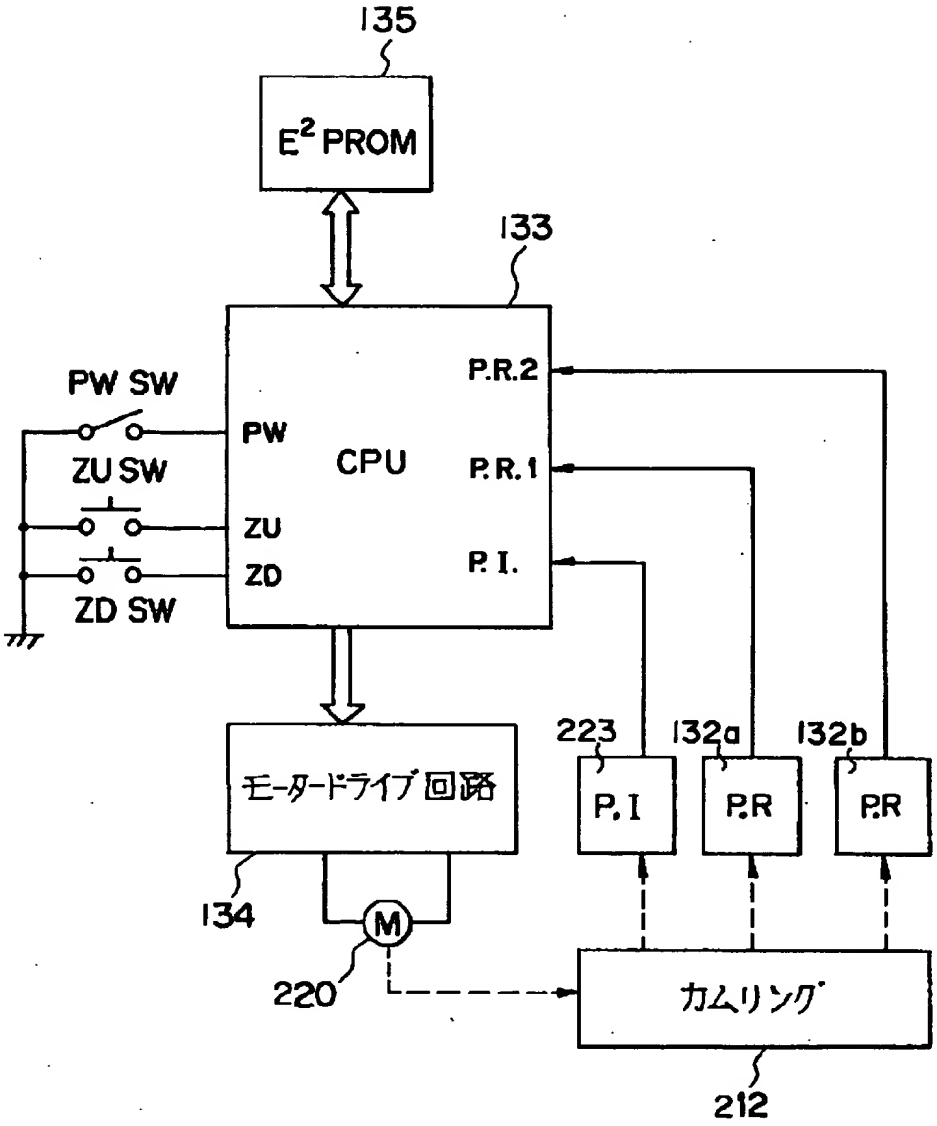
【図9】


ZOOM
S501
INIT
S502
ZUDF
1(UP)
0(DOWN)
S503
ズームモータ逆転
S504
ズームモータ正転
S511
ZSWSK
OFF
ON
S512
ZOMOK
Y
N
S513
ZPRCK
S514
タイマスタート
S515
ZMPIRD
有
無
S521
DAMAG
S516
ZUDF
1
0
S517
BKRUSH
S518
ZMMOTB
S519
ズームモータ停止
S520
RET

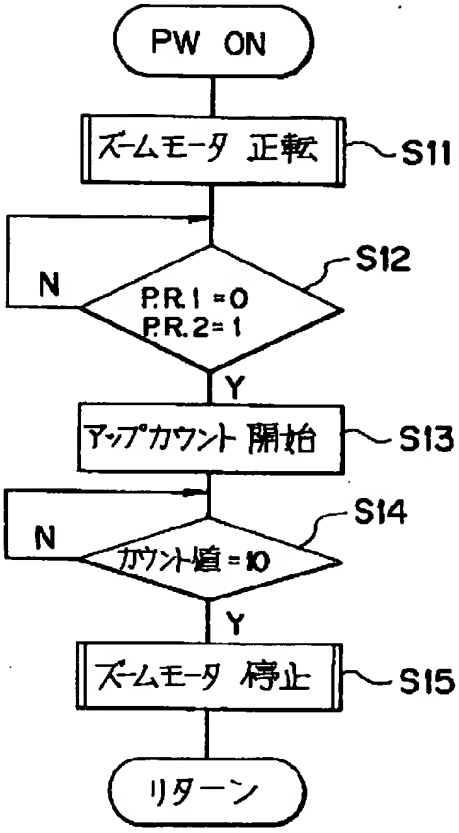
【図13】 2nd


130 pattern
131a
130a
130b
131b
PR1
PR2
1
0
0
1
1
1
0
0
沈洞位置
W端位置
S位置
T端位置

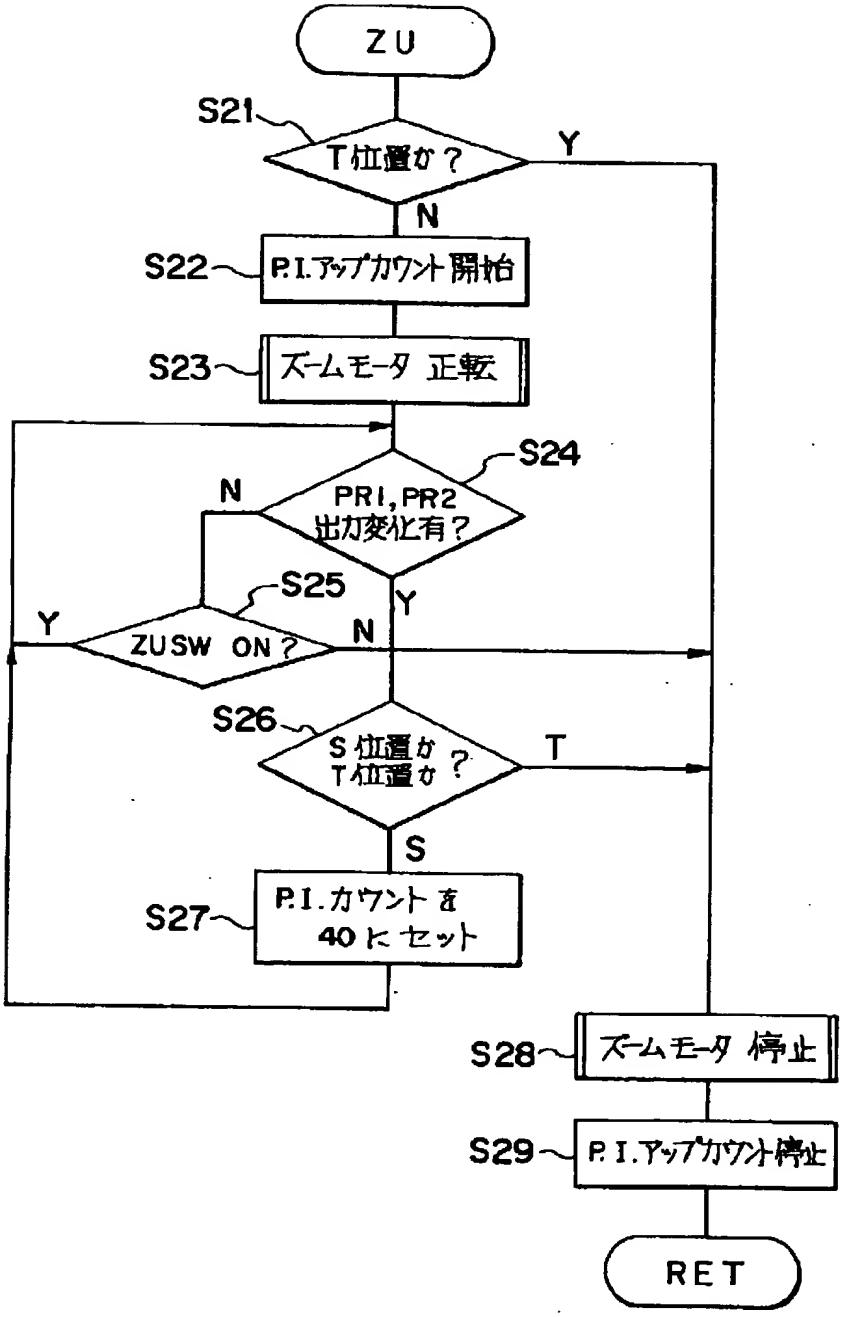
【図14】


135
E² PROM
133
PW SW
ZU SW
ZD SW
PW
ZU
ZD
CPU
P.R.2
P.R.1
P.I.
モータードライブ回路
134
M
220
223
132a
132b
P.I
P.R
P.R
カムリング
212

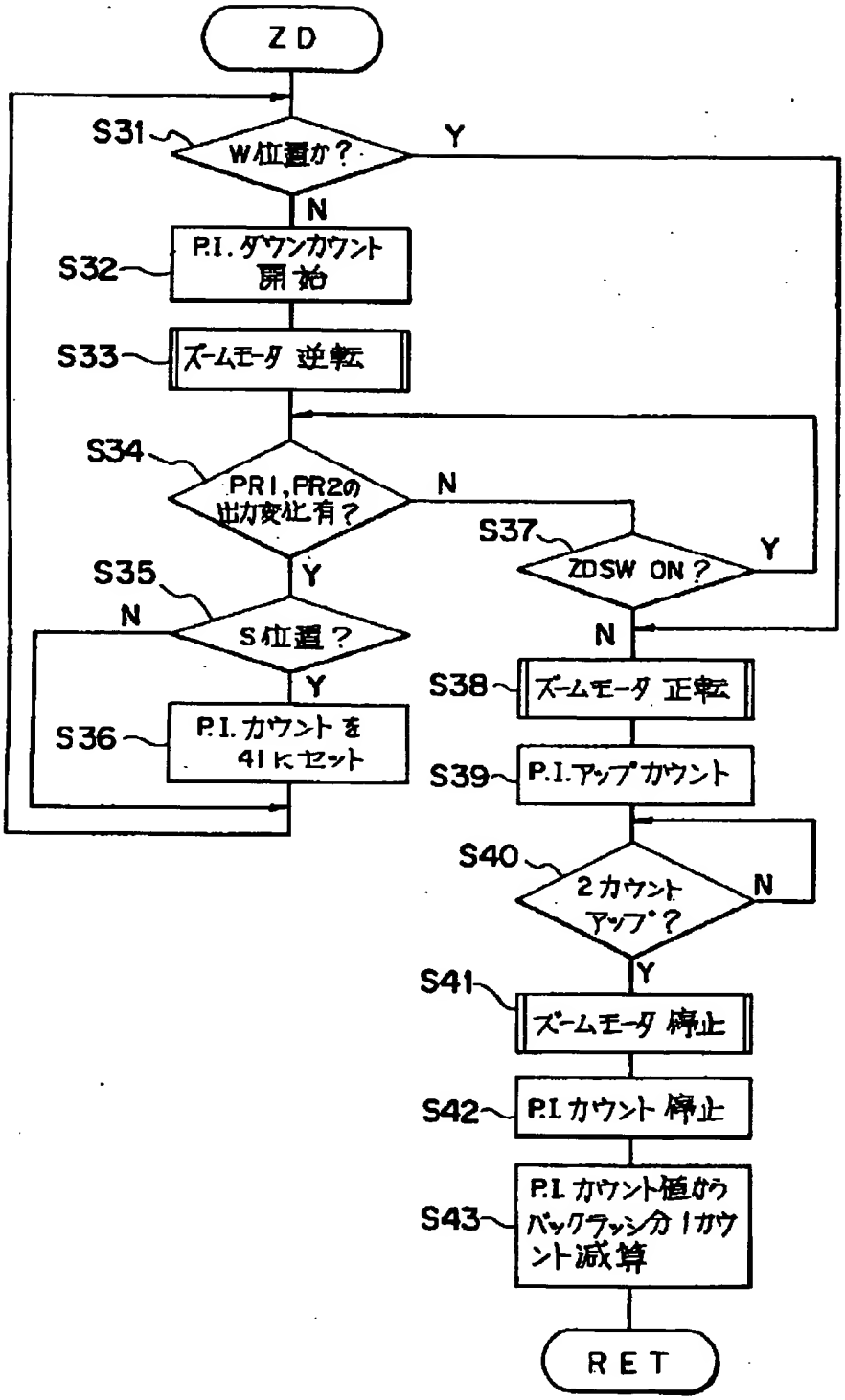
【図16】


PW ON
ズームモータ 正転
S11
S12
N
P.R.1 =0
P.R.2=1
Y
アップカウント 開始
S13
S14
N
カウント値=10
Y
ズームモータ 停止
S15
リターン

【図17】


ZU
S21
T位置か？
Y
N
S22
P.I.アップカウント開始
S23
ズームモータ 正転
S24
PR1,PR2
出力変化有？
N
Y
S25
ZUSW ON？
Y
N
S26
S位置か
T位置か？
T
S
S27
P.I.カウントを
40にセット
S28
ズームモータ 停止
S29
P.I.アップカウント停止
RET

【図18】


ZD
S31
W位置か？
Y
N
S32
P.I.ダウンカウント開始
S33
ズームモータ 逆転
S34
PR1,PR2の出力変化有？
N
Y
S35
S位置？
N
Y
S36
P.I.カウントを41にセット
S37
ZDSW ON？
Y
N
S38
ズームモータ 正転
S39
P.I.アップカウント
S40
2カウントアップ？
N
Y
S41
ズームモータ 停止
S42
P.I.カウント停止
S43
P.I.カウント値からバックラッシ分1カウント減算
RET

【手続補正書】
【提出日】平成４年１０月２日
【手続補正１】
【補正対象書類名】明細書
【補正対象項目名】００５６
【補正方法】変更
【補正内容】
【００５６】このステップＳ５１２では、ズームレンズの現在値を示す上記ＺＭＰＬＳによりズーム位置がワイド端位置あるいはテレ端位置になったかを判定し、ワイド端位置，テレ端位置のどちらかになった所で、上記ズームモータ３１を停止しステップＳ５１６へ進む。また、上記ステップＳ５１２で、ズームレンズ位置がワイド端位置あるいはテレ端位置に達していないときは、次にステップＳ５１３に進む。
【手続補正２】
【補正対象書類名】明細書
【補正対象項目名】００５８
【補正方法】変更
【補正内容】
【００５８】この後、ステップＳ５１４でフォトインタラプタ３４（ＺＰＩ）の検出用タイマをスタートさせ、ステップＳ５１５で、該フォトインタラプタ３４のパルス立上りをチェックして上記ＺＭＰＬＳをカウントアップもしくはカウントダウンする。ここで、一定時間内に該フォトインタラプタ３４の立上りがなければズームモータ３１あるいはズームエンコーダ１０の故障と判断して、ステップＳ５２１の異常処理（ＤＡＭＡＧ）へ行く。ＺＭＰＬＳがズームアップのときテレ端，ズームダウンのときワイド端の場合もＳ５１１へ進む。